MUSIC & Computers

NOV/DEC 1997™

THE MAGAZINE FOR DES

U2 Live!

The Computers Behind PopMart

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COVER PHOTO: **JOHN POPPLEWELL/RETNA**

From the Editor

Big news: Response to *Music & Computers* has been so outstanding that we're adding two more issues in 1998. *M&C* will now hit the newsstands eight times a year. The eight issues will be spread out evenly, albeit with tricky names like Jan/Feb, March, April, and May/June, so if you're worried about missing an edition, stop by our Web site and check the publishing schedule or fill out our new automated subscription form.

When I took this gig, I just thought it would be fun to share some of the techniques I've discovered making music with computers over the last 15-odd years. I didn't realize I'd be learning so much as well. On a recent trip up to Seattle to attend the GS Developers' Conference, for example, I saw some remarkable trends.

GS, as you may know, is Roland's extension to the General MIDI (GM) spec. GM-compatible instruments have 128 standardized sounds; GS ones have 226. GS instruments also respond to more types of MIDI controller data. Ho hum. Hardly seemed like enough to base a conference on, especially since the big buzz in desktop music today is digital audio.

But in a series of presentations from speakers as varied as composer Bobby Prince and Intel spokeswoman Suzy Meier, it became clear that not only is there a lot of untapped potential left in MIDI, the GS spec is going to be pretty important — mainly because the next version of Windows will include a built-in GS-compatible software synthesizer.

Tapping the full potential of MIDI will be an interesting challenge. Throughout the conference, our hosts from Edirol and Roland played some of their favorite MIDI files. The extra goodies available through GS helped to add expressiveness, and there were occasional flashes of brilliance, but late in the day Keyfax Software president Julian Colbeck weighed in with a poignant comment: "We now have all these fantastic tools, but where's the content?"

I had to agree. Much of the music failed to move me. This coming year, let's all try to push the envelope of expressiveness a little further.

What holds back content? In his presentation, MIDI Manufacturers' Association president Tom White said that one problem was the lack of a common playback experience. In other words, if you create a MIDI file and post it on your Web site, most of your visitors will hear it play back with subtly or radically different sounds — even if you compose it for General MIDI — because GM just specifies sound *names*, not their qualities. When everyone has a compatible software synth on their computer, this problem will disappear.

But it goes further than that. After the conference, I dropped by Microsoft to visit with the DirectMusic team. They demonstrated the upcoming DirectMusic component of Windows, which has three parts: the GS software synth, the interactive music engine (see our tutorial in the Sept/Oct '97 issue), and DLS (downloadable sound) support.

DLS lets you play your own digital audio samples from the software synth *and* save them in the song file, so if your composition depends on a hand-over-the-vacuum-cleaner-nozzle solo, you won't be forced to approximate that sound with a GM preset. Essentially, MIDI becomes a control language for digital audio, providing a music delivery system that is simultaneously compact, consistent, and highly customizable. This is big news too.

—*David Battino*

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The success of any music production is always contingent on the harmonious integration of the components used in its creation. The Audiowerk8 Home Studio Kit delivers this level of integration by providing an exceptional quality PCI Digital Audio Recording card and cutting edge sequencing and DSP software all in one package. With this combination even very complex musical compositions become a no hassle reality. You deserve the best and here's the deal.

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the powerful 7" PCI recording card with 2 analog inputs, 8 discreet outputs and digital I/O (S/P-DIF format). Equipped with the latest PCI busmaster technology, it optimizes the performance of your system by reducing the load on your computer's processor. The Continuous Sample Rate Calibration allows for perfect synchronization, even when using very long audio files. This card gives you all of the advantages of non-linear recording technology on Windows 95 and MacOs.

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- 2 analog Inputs
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- Sample rate variable up to 50 KHz, Res. 1 Hz
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Nuts to the Left

Although I don't always agree with your reviews, I do like your publication. As a guitar player and a computer enthusiast, I have a question concerning guitar-oriented software programs: Why is the graphical display always upside down and backwards (high E on top and the nut to the left of screen)? This bugs my buns! I teach at a university, and if one of my students developed software with such a display, they would receive an "F" for their effort. It is just so awkward.

Mel L. Strait
Dir. Radio/TV
Texas A&M University-Kingsville
via Internet

Mel — Andy Ellis, lessons editor at our sister magazine Guitar Player, *replies, "I completely agree and have busted software myself for the same reason. It's simply wrong. The neck should look the way it does when you're staring at your teacher's (or student's) fretboard: Low E on top, nut to the right."*

According to two guitar software companies we contacted, Play Music and eMedia, the nut-on-the-left design has become common because it's consistent with the layout of guitar tablature. It also approximates what you'll see if you look down at your fretboard while playing. However, Play Music's newer programs offer nut-on-the-right views as well.

Coincidentally, reader Marty Balash wrote to tell us about Desktop Guitarist, his new Windows shareware. Visit www.wtco.net/homepages/martyb/dtghome.html *to see which way his guitar faces.*

MIDI Freak Finds Spot

Music & Computers has really hit the spot with me. I am a 53-year-old MIDI freak. For hours I sit with my [PG Music] Band-in-a-Box and Midisoft Studio 4 programs and work up mostly blues backgrounds, some old and some original. Your articles have been of great help in setting my system for optimum sound.

The setup that I use is as follows: Bass, drums, piano, various keyboards, background guitars, and horn parts go into my computer using a Roland U-20 keyboard. Then I dump that into a TEAC A-2340 4-track recorder through a Mackie 1402-VLZ mixer and a Korg DRV-1000 reverb. Then I add voice, lead guitar, and harmonica into the remaining three tracks. Finally, I mix down to a TASCAM 32 or a Sharp cassette.

Austin Pate
via Internet

Shareware You Are

It was nice to see the mention of my [analog sequencer] program, Seq-303, in the May/June '97 letters column, and also tremendously coincidental: I picked up the mag the day after I released the shareware version (v 2.0). This has a whole slew of new features that I won't bore you with at the moment. Well, maybe just a few: MIDI file export, NRPN support, and rock-solid timing. If you'd like to check it out, drop by www.technotoys.com.

Jim Johnson
Metaphoric Software
via Internet

What to Buy?

I have been tasked with assisting our humanities department in the design and construction of a computer music training lab. I have very little experience in this field and only about $150,000 to put it together. I ran across your Web site and hoped you might be able to recommend some back issues that would give me some insight and direction.

The basic idea is 26 high-end Pentiums with keyboards and whatever else we can afford, running Win95 or NT attached to an ATM network. Teach, create, mix, record — all those music kinds of things. I need some direction on hardware and software.

James R. Beidler
jbeidler@cscc.edu
via Internet

James — You could do a fine job for $150,000, but we highly recommend working backwards from the curriculum — deciding first what skills you want to teach — rather than buying a truckload of equipment and trying to make it work. For example, it's not clear why you specified 26 high-end computers. It might make more sense to buy twice as many midrange ones, or half as many along with more peripheral gear.

M&C *features a regular column called "Computers in Education." The Jan/Feb '97 edition, entitled "Building a Music Technology Program," would be a great place to start. Also, our Jan/Feb '98 issue (on sale Jan 6, 1998) will have a special focus on computers in music education.*

ILLUSTRATIONS: **ROBERT PRINCE**

Single, dual, quad, Pentium, Pentium Pro, K6, M2 Pentium II, MMX, Alpha, 200MHz, 233, 300, 400? Which one? I want to record, mix, master, and burn a CD. What's the right processor for me? I know it depends on the software, but the manufacturers all say a little extra speed won't hurt. What they don't say is . . . will it help? When does the processor become overkill? I'm considering purchasing one of the following: Cakewalk Pro Audio, [Steinberg] Cubase Audio VST for Windows with WaveLab, or [Emagic] Logic Audio for Windows. Can you help?

Desperate in Detroit
via AOL

Desperate — You don't need an Alpha. According to both Steinberg and Emagic, the optimum Windows-compatible chip for desktop digital audio right now is a 300MHz Pentium II, but both companies say a Pentium 166 will do a fine job. The rule of thumb is to get the most powerful processor you can afford, and not skimp on RAM: Emagic recommends at least 32MB, though 64MB would be best. Steinberg adds, "The RAM and the hard disk speed determine the number of tracks, and the processor speed determines the number of realtime effects you can run."

Since both programs do their audio calculations in the FPU (floating point unit), which is not accessed by MMX commands, MMX capability provides at most a 15% increase in performance. Dual/quad processor support will probably emerge in music programs before long, but it currently requires Windows NT, and none of the three sequencers you mentioned runs under NT yet.

Better Sound for Free

I'm a young composer who only recently became involved with MIDI and using computers to make music. I've been recording samples of my music onto cassette tape by utilizing the primitive method of running a cable between the headphone jack of my Yamaha PSR-320 keyboard and the microphone port on a cassette tape recorder, then pressing the record button and playing pre-recorded MIDI files.

The resulting sound quality is often less than ideal. Is there a way to record my music onto cassette tape and produce good sound quality, while keeping any equipment upgrades at economical costs?

Thomas Robinson
via AOL

Thomas — Here's a free way: Connect the line outputs of the keyboard to the line inputs of the cassette deck. Headphone jacks put out a strong signal, while mic inputs expect a weak one; the resulting level mismatch can cause distortion. In addition, both stages contain amplifiers that can add noise to the signal. You can also improve recording quality by cleaning the cassette deck's heads and using high-quality tape.

I'm a computer composer and I'm interested in getting better sounds out of my MIDI [setup]. However, I have no idea what I should use to get better sounds without buying a keyboard. If you could just point me in the right direction, I would be pleased.

Matt Singer
via AOL

Matt — A MIDI system is like a musical instrument in itself: The sound depends on both the quality of the instrument and the skill of the player.

We'd guess you're relying on your computer's soundcard for MIDI playback, so one solution would be to upgrade to a better soundcard (see Scott Garrigus's last two "How Do I . . . " columns for tips). If your soundcard supports it, you could also upgrade by adding a daughterboard such as the Yamaha DB50XG (reviewed in our Sept/Oct '96 issue). Buying an external MIDI sound module is another option; that would be cheaper than a new keyboard.

To help you take the player approach, M&C regularly offers tips. See "Make Your MIDI Files Come Alive!" (Nov/Dec '96) and "MIDI File Power-User Tips" (May/June '97). Also, Keyfax Software makes an outstanding collection of MIDI phrases (called Twiddly Bits) that can be dropped into your sequences to add spice. We reviewed two Twiddly disks in our July/Aug '97 issue. (Note that we ran the wrong phone number for Keyfax. The correct number is 800-752-2780.)

Sync You Very Much

I've been buying your magazine since it first came out and have kept all the issues as reference. Thank you for creating and writing a publication that doesn't mind addressing the novice. As a performer for many years, [I find] desktop music gives me a chance to expand my horizons and use the experience I've gathered in a new and exciting direction. (It sure beats carrying around all that equipment from gig to gig, too!)

I own a TASCAM 4-track Midistudio (analog cassette deck). When I purchased the deck, I was told that I needed to use one of the tracks for a time clock when recording from a sequencer. I've tried to find out more information on this, but [it's always] in very technical language. Why can't I just record from my sequencer on one track and add other instruments/vocals on the other tracks? When and why do I

wanted is finally within your reach.

Access Sheer Digital Audio and MIDI Power
Imagine managing up to 16 tracks of digital audio with sophisticated MIDI sequencing all in one package. Fueled by an amazing 50 MIPS Digital Signal Processor, 64-voice wavetable synthesis in hardware, and 4 MB RAM, Home Studio Pro 64 lets you control up to 8 wave ports and 64 MIDI tracks. You want control?
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It's packing 4 kHz - 44.1 kHz 16-bit stereo sampling, CD-quality record and playback. It's got high-quality 16/18-bit ADC/DAC converters. It features enhanced full-duplex hardware for simultaneous record & playback and two-way conversation over the Internet. It delivers customizable 4-band paragraphic EQ for precise tonal control on mix-out. It boasts 2 stereo outputs that let you hear surround sound and 3D positional audio on 4 separate speakers. And it includes a digital I/O (S/P DIF - 44.1 kHz) and an analog I/O so that you can achieve pure, studio-quality fidelity.

Make A Sound Investment
Upgrade to 96 voice polyphony with a 32-voice daughtercard and add external synthesizers to manage up to 32 MIDI channels. Add up to 20 MB RAM for creating and downloading your own soundbanks. It's fully Plug & Play and Sound Blaster Pro compatible, and most importantly, it supports GM, GS, XG, DLS and Roland MPU-401. It's optimized for Pentiums and up, but will run great on your old 486 with a fast hard drive, no matter what your CPU.

Change tempo and measure counts on each active track

Zoom-in on any track for a closer look

See and control transport functions of the sequencer and set global parameters

MIDI clock lets you synchronize in Master or Slave mode

Intuitive editing tools let you edit your masterpiece with ease

User-friendly, object-oriented interface

Mix both MIDI and wave audio tracks. Control up to 2 MIDI ports and 8 wave ports at once.

Play up to 8 stereo tracks simultaneously with real-time control on each track

Visualize and adjust Pitch Bend or After Touch events in the Controller window with intuitive editing tools

Control real-time effects on both wave and MIDI tracks

Hook a keyboard up or use the on-screen keyboard provided for your MIDI compositions

Control effects for each audio port. Use up to 2 effects on each port.

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Continued from page 8

need a separate track for a time clock and how do I initiate it?

Deena Javor
via Internet

Deena — Your "record one track, overdub three" technique will work, but it has a few drawbacks. For one, it means your MIDI parts will always be mixed down to mono, since they go to only one track of the tape. Second, should you want to change some aspect of the MIDI part — say, the balance of the different synthesizer sounds — after you had recorded your vocal, it would be almost impossible to get a new recording of the synths to line up with the vocal already on tape. Even if you hit Play on the sequencer at exactly the right instant, the tape recorder would soon drift out of sync.

By recording a sync signal such as SMPTE time-code or FSK onto one track of the tape, you can lock the computer's playback to the tape deck's. This means you'll still have three tracks available to record non-MIDI instruments, and all your MIDI tracks will remain editable (and stereo) all the way to mixdown.

Most mid- to high-end MIDI interfaces have synchronization capability built in. To use it, you work out your song in your sequencer, set the interface to generate a sync signal, then record it to tape as the song plays back. Next, you switch the sequencer into "external sync" mode, connect the tape track's output to the interface's sync input, and play the tape. When the computer sees the sync signal, it will start playing and remain locked to the tape. Then you're free to record on the other tape tracks. The TASCAM Midistudio series actually had built-in sync reader/generators, so you won't even need external hardware. Look for a detailed article on synchronization in an upcoming issue of M&C.

Rave the Wales

J ust a note to say, "Hi, excellent mag." I'm in Wales in the U.K. and have had your magazine since the first issue. I know it sounds corny, but keep up the good work. You inspire me to record stuff every time a new issue comes out.

Tom
via Internet

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Turn your PC into a power
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IT'S A HARDWARE/SOFTWARE BUNDLE

The E-mu® Creation Studio combines the Creative Labs AWE64 Gold™ audio card and full versions of Cakewalk Express SE v5, Sonic Foundry SoundForge XPv3.0, SoundTrek JAMMER Hit Session, Creative Labs' Vienna SoundFont® Studio, SoundFont banks and MIDI files. Software valued at more than $300.00.

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The **Creative Labs AWE64 Gold ISA** card supports 32 MIDI channels—16 via the internal wavetable synth and 16 more via the MIDI interface. We include General MIDI banks along with hundreds of other SoundFont presets for you to use. We even throw in a free MIDI cable.

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and harmoni

REA

Cutting Edge

by John Krogh & Debbie Greenberg

For more information about the products and companies featured in Cutting Edge, fill out the free Reader Service Card bound next to page 77 and drop it in the mail.

PC

What makes the **Audiotrix 3D-XG** ($295) from **MediaTrix Peripherals** stand out in the sea of PC soundcards? For starters, it offers a Yamaha XG sound set, which includes 676 programs and 21 drum kits. The effects section features reverb, chorus, and other effects not commonly found in soundcards, such as early reflection, 3D surround sound, rotary speaker simulation, and voice cancellation. The latter effect lets you perform karaoke sing-alongs by reducing the volume of vocal tracks from CDs in real time. The effects can be applied to the synthesizer sounds, to CD audio, and to .WAV file playback.

Multiple PC operating systems are supported, including Windows 3.1/95/NT as well as OS/2, Warp, and Linux. **Contact:** MediaTrix Peripherals, 4229 Garlock St., Sherbrooke, Quebec, Canada J1L 2C8; 819-829-8749; fax: 819-829-5100; e-mail: sales@ mediatrix.com; Web: www.mediatrix.com. *Circle #162 on reader service card.*

Are you brass players feeling left out of the electronic music scene? **Yamaha's Silent Brass System** could be just what you need to get plugged in. The system includes two parts: a special horn mute with a built-in mic, and a small control module that processes the mic's audio signal. The control unit has two ⅛" mono inputs (so you can play duets with a friend) and one ⅛" stereo auxiliary input into which you can plug a CD player or other audio source. You can adjust the level of each signal and apply three different types of reverb to the mono inputs.

The control module features two headphone outputs and one ⅛" stereo line-level output, which can be plugged into tape recorders, effects pedals, or your computer's audio input. Silent Brass systems are available for trumpet ($299), trombone, French horn, and flugelhorn ($329 each). **Contact:** Yamaha, Band & Orchestral Division, P.O. Box 899, Grand Rapids, MI 49512; 616-940-4900; e-mail: info@yamaha.com; Web: www.yamaha.com. *Circle #161 on reader service card.*

PC

When you surf up and down the FM radio dial, you might notice that certain stations have their own unique sonic quality — maybe an accentuated high end or a fat low end. This is the result of some behind-the-scenes audio processing that allows broadcasters to enhance the sound your radio receives. **Cutting Edge** (great name!) has brought this same audio enhancing capability to Webcasters with the **Omnia.net** digital signal processor ($8,200).

The Omnia.net supports MPEG files for streaming audio in real time over the Internet. Webcasters can set up and control the processor through any Web browser. Communication between your computer and the Omnia.net can be made via local serial RS-232, modem, 10BaseT, and the Internet, so you can configure and operate the unit from wherever you happen to have Internet access. **Contact:** Cutting Edge, 2101 Superior Ave., Cleveland, OH 44114; 216-241-3343; fax: 216-241-4103; Web: www.zephyr.com. *Circle #163 on reader service card.*

The perfect melodies or lyrics can come to you at any time, anywhere. Wouldn't it be nice to reach into your pocket, press a button, and *digitally* record these inspirations? You can with a pocket-sized (⅜" thick, 4" long, 2½" wide) digital recorder/player from **E.W. Bridge**.

The **Musician's Pocket Memo** has a seven-button keypad, microphone, and speaker that reportedly provides better sound quality than most portable cassette recorders. Memos can be deleted individually, letting you save important notes while removing others to free up more recording space. Although recording is mono, ⅛" stereo jacks let you connect to peripherals such as external mics and speakers.

Two models are available: The SPE25A-2J-EW ($119.95) can record up to 9.5 minutes at highest quality and 25 minutes at lower quality, while the SPE50A-2J-EW ($239) can record up to 19.1 minutes at highest quality and 50 at lower quality. **Contact:** E.W. Bridge, 1645 W. Selby Ln., Redwood City, CA 94061; 888-248-3628 (orders) or 650-365-4916; fax: 650-261-2172; e-mail: sales@ewbridge.com; Web: www.ewbridge.com. *Circle #164 on reader service card.*

Is it tape or is it **Sidex**? This $90 personal handheld digital audio recorder from **MicroCharg** offers all the traditional tape recorder functions, but without the tape. Audio is recorded through a built-in microphone and stored on interchangeable S-mind memory cards, which are available in 14-, 28-, 56-, and 112-minute capacities ($110, $159, $199, and $249, respectively). Sidex automatically locates free recording space on the card, and allows you to insert memos without erasing previous messages. Messages can be recorded and stored safely for up to ten years. In addition, audio from the S-mind cards can be downloaded to your computer or uploaded to the Internet via a PCMCIA LAN (local area network) I/O card ($99). **Contact:** Leading Accessories, dist. by MicroCharg, 420 Prairie View Ln., Mason City, IA 50401; 800-686-4728 or 515-422-9330; fax: 515-423-1411. *Circle #165 on reader service card.*

Wouldn't it be nice to create your own multimedia presentations without spending a fortune on hardware and software? **Iomega** has announced a software/hardware package appropriately called **Buz** ($199) that lets you feed video, music, and digitized photos into your computer, then edit and add special effects to create your own presentations.

The hardware side of Buz consists of two pieces: A PCI card with video-capture and SCSI control functions — which allow you to connect and address other SCSI peripherals like hard drives — and a breakout box that provides RCA-format I/O jacks for analog audio, composite video, and S-video.

On the software side, MGI VideoWave SE Plus lets you capture and edit video, and combine animation, graphics, and sound. PictureWorks Hot-Shots lets you prepare and enhance digital images. And Iomega RecordIt lets you record and edit digital audio. A CD-ROM tutorial walks you through installation and creating your first multimedia project. **Contact:** Iomega, 1821 W. Iomega Way, Roy, UT 84067; 801-778-1000; fax: 801-778-5632; Web: www.iomega.com. *Circle #166 on reader service card.*

Creating cross-platform multimedia presentations is as easy as dragging and dropping files within **InMedia's Slides & Sound Plus** ($69.95). A variety of file types is supported, including AVI and QuickTime movies, PICT, TIFF, JPEG, .WAV, and AIFF. Slide shows are created by dragging and dropping the video/graphic, audio, and text files into order of appearance. Special effects, transitions, and Adobe Photoshop plug-ins can be applied to help you polish your presentations. The "Send to Mac" and "Send to PC" commands let you share your presentations via e-mail with other Mac and PC users. **Contact:** InMedia Presentations, 800-900 W. Hastings St., Vancouver, BC, Canada V6C 1E5; 604-893-8955; fax: 604-893-8966; Web: www.inmediapresents.com. *Circle #168 on reader service card.*

Sometimes connecting all the pieces of a computer workstation isn't as easy as one might expect — especially when it comes to classrooms or recording studios. Fortunately, the folks at **NTI** have a number of products aimed at meeting nearly any routing and connection need you could imagine. For example, the **TCH-CNTL-24** teacher control unit ($710) allows up to 24 student workstations to view the onscreen display of a central "instructor" workstation, while at the same time allowing the instructor workstation to view the display of any remote student workstation.

With NTI's huge assortment of custom cables and connectors, you'll be able to put enough distance between you and your CPU to reduce annoying fan noise from your recording environment. **Contact:** NTI, 1275 Danner Dr., Aurora, OH 44202; 800-742-8324 or 216-562-7070; fax: 216-562-1999; e-mail: sales@networktechinc.com; Web: www.networktechinc.com. *Circle #167 on reader service card.*
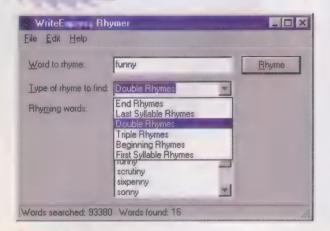
Cutting Edge

Looking for an easy way to create and print charts for cover tunes and original songs? Take a peek at **Memphis** ($59), **Passport's** Windows 95 software designed for musicians, lyricists, and songwriters. Memphis's Lyric View is divided into song sections where you can type in and print out words in couplets or however you want to view them. Other lyric-related features include a spell-checker, a rhyming dictionary, a thesaurus, and the ability to import text saved in Rich Text Format (RTF) or as a standard text file.

Song View lets you prepare the final layout of your song by grabbing and dragging text to align it with chord progressions on screen. Chord View shows the song structure along with guitar chord diagrams. The program comes with a library of over 700 chords and an editor called Fret Foundry, which lets you create and store custom guitar chord diagrams complete with fingering numbers.

Contact: Passport Designs, 1151-D Triton Dr., Foster City, CA 94404; 650-349-6224; fax: 650-349-8008; e-mail: info@passportdesigns.com; Web: www.passportdesigns.com. *Circle #170 on reader service card.*

Got a word you want to rhyme, but find brainstorming's a waste of time? **WriteExpress Rhymer and Phonetic Finder** ($29.95) to the rescue. The Rhymer is an electronic dictionary that lets you search for words based on rhyming parameters such as first syllable, last syllable, and double, triple, beginning, and ending rhymes. You can specify the number of syllables or letters you want in your search.

Phonetic Finder's word searches are based on phonetic patterns that you assemble by choosing symbols from a linguistic chart with vowels, stops, fricatives, affricatives, liquids, and glides. Both programs share a database of over 93,000 words and work with Windows 3.1 or 95. A free demo with 24,000 words can be downloaded from the WriteExpress Web site. **Contact:** WriteExpress, P.O. Box 1050, Orem, UT 84059-1050; 800-974-8339; fax: 801-226-1291; Web: www.WriteExpress.com. *Circle #169 on reader service card.*

Thinking about learning guitar? Take a trip to **Guitropolis** ($49.95). This new CD-ROM from **Alfred Publishing** places you in a futuristic virtual city where you can explore guitar lessons and topics ranging from purchase and maintenance tips to pull-offs and hammer-ons. Lessons cover rock, blues, country, heavy metal, jazz, and folk styles using a library of over 60 songs with audio accompaniment. A guitar tuner, fingerboard chart, and chord dictionary are also included. **Contact:** Alfred Publishing, P.O. Box 10003, Van Nuys, CA 91410; 818-891-5999; fax: 818-893-5560; e-mail: alfredpub@aol.com; Web: www.alfredpub.com. *Circle #171 on reader service card.*

Electronic Courseware Systems (ECS) is at it again — they've added several new programs to their already extensive line of music education software. Use **Aural Skills Trainer** ($99.95) to work on perceiving and identifying intervals, basic chords, and seventh chords. **Functional Harmony** ($149.95) can help you develop facility in harmonic analysis. In Section 1, you can practice analyzing basic chords in major or minor keys and in root position or inversions.

Sections 2 and 3 present diatonic seventh chords and secondary dominants, respectively. Section 4 completes the set with practice on borrowed and altered chords.

For a tutorial on major, minor, diminished,
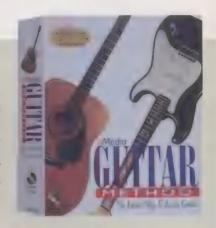
and augmented chords, check out **Keyboard Chords** ($79.95), which offers a chord spelling drill, keyboard drill, and test. Learn to play major, minor, diminished, and augmented intervals with **Keyboard Intervals** ($79.95). Demo versions of these and other programs are available from ECS's Web site. **Contact:** Electronic Courseware Systems, 1210 Lancaster Dr., Champaign, IL 61821; 800-832-4965 or 217-359-7099; fax: 217-359-6578; e-mail: sales@ecsmedia.com; Web: www.ecsmedia.com. *Circle #172 on reader service card.*

Updates

eMedia has updated their Windows guitar tutorial package (60 lessons, 30 full-motion instructional videos, and three hours of recorded audio) and made it available for the Mac. Enhancements to the **eMedia Guitar Method** music education CD-ROM ($59.95) include music tracking, which lets you follow along in karaoke style with the 100 songs and exercises provided, new audio/video controllers for fast-forwarding and rewinding to particular sections of songs and videos, additional instructor comments, and an aesthetically upgraded interface design. **Contact:** eMedia, 2403 E. Aloha St., Seattle, WA 98112; 206-329-5657; fax: 206-329-0235; Web: www.emedia.org/guitar.html. *Circle #173 on reader service card.*
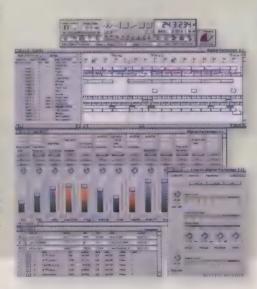
The latest version of **Cakewalk's** MIDI and digital audio workstation for Windows adds several new DSP (digital signal processing) commands to the program's audio editing tools. **Cakewalk Pro Audio 6.0** ($429; upgrade from v4.0/5.0 $129) offers time-stretching, pitch-shifting, EQ, delay, chorus, reverb, and flanger. Version 6.0 fully supports Microsoft's ActiveX realtime audio plug-in standard, which allows you to apply audio DSP effects to your digital audio files in real time.

Other new features include percussion notation, the ability to add markers on the fly, and display of markers in controller and tempo views, piano roll, and audio views. The new version ships with Cakewalk StudioWare, which lets users design custom interfaces within the Cakewalk application to control a variety of studio hardware. Templates include the Roland VS-880 and SC-88, TASCAM DA-38, Yamaha ProMix 01 and MU80, and more. **Contact:** Cakewalk Music Software, P.O. Box 760, Watertown, MA 02272; 800-234-1171 or 617-926-2480; fax: 617-924-6657; Web: www.cakewalk.com. *Circle #174 on reader service card.*

**Mark of the Unicorn** (MOTU) has upgraded their digital audio/MIDI sequencer, **Digital Performer 2.1**, to be Power Mac native, resulting in better performance with audio recording and mixing features. The new version supports Apple Sound Manager, so you can record and play digital audio on a Power Mac without installing extra hardware. On a medium-fast Power Mac (604e/150MHz), users can play 16 to 24 tracks of audio. On a fast Power Mac (604e/225) equipped with SCSI acceleration, users can play up to 40 tracks.

Pricing is as follows: Version 2.1, $795; competitive upgrade (cross-grade) from another sequencer or audio sequencer, $395; upgrade from Performer, $295; upgrade from Digital Performer 1.71 or earlier, $149; update from Digital Performer 2.0, free (shipped automatically to all 2.0 users). **Contact:** Mark of the Unicorn, 1280 Massachusetts Ave., Cambridge, MA 02138; 617-576-2760; fax: 617-576-3609; e-mail: info@motu.com, Web: www.motu.com. *Circle #175 on reader service card.*

Berkley Integrated Audio Software (BIAS) has upgraded **Peak**, their stereo audio editing program (reviewed in the July/Aug '97 *M&C*), to version **1.6** ($499; $129 from v1.0, free upgrade from v1.5). Enhancements include faster sample data transfer rates between computer and external samplers and the ability to send/receive both individual and groups of samples to and from Akai S1000, S2000, S3000, and Roland S-760 samplers. Peak can now be used as the default digital audio editor from within MOTU Digital Performer and Steinberg Cubase Audio/VST MIDI sequencers. **Contact:** BIAS, P.O. Box 2481, Sausalito, CA 94966; 415-331-2446; fax: 415-331-2446; e-mail: sales@bias-inc.com; Web: www.bias-inc.com. *Circle #176 on reader service card.*

Cutting Edge

Seattle Isn't Dead

by John Krogh

The Experience Music Project music museum and its interactive Web site were launched during a groundbreaking ceremony held in June, just blocks away from Seattle's Space Needle. EMP is a privately funded, non-profit organization whose mission is to encourage people to listen, learn, and participate in making music by offering exhibits, educational programs, and live performances from well-known artists. The EMP Web site, www.experience. org, which is an extension of the 130,000-square-foot building, gives visitors a chance to preview artifacts from the physical museum, and explore a variety of online-only exhibits. The site is divided into eight main areas: Northwest Passage, EMP Backstage, Guitars, Revolutions, Set List, World Jam, Jimi, and The Vault.

The Guitars portion traces the timeline of the electric guitar, from the dobro to the Fender Stratocaster. In addition to viewing pictures and specs for each guitar in the museum, online visitors can hear what these guitars sound like by "strumming" over the strings with their mouse. (See Figure 1.)

In Revolutions, contemporary artists who have helped shape rock 'n' roll discuss their musical influences. However, this page isn't just for musicians, as Diane Andolsek, project manager for EMP's Web site, explains. "Revolutions is for anybody who is interested in music, or interested in the creative process. We're really taking a look at the relationship side of music, kind of like

a mini-documentary. There's something for anybody who's at all curious about American popular music." Each interview will stay on the site for approximately six weeks and include streaming audio and video of artists discussing who or what influenced their music.

World Jam is the community area of EMP online, offering musicians and non-musicians alike the opportunity to exchange musical ideas. These ideas can be shared with other members (membership is free) by uploading .WAV, .AIFF, .MID, and Real-Audio files to the Virtual Bands section. You can also post and browse classified ads for musicians wanted/needed here.

Probably the hippest spot in World Jam is the Mixing Room, where anyone can create their own music online. This is done by clicking on icons that represent musicians (drummer, guitar player, keyboardist, and bassist) in a virtual band. As you click on these icons, an image of each member appears for their respective instrument (see Figure 2). In addition to selecting instrumentation, you can also choose the genre of music (jazz, funk, fusion, reggae, country, rock, and pop) that each instrument plays. When you press play, each "musician" plays a short phrase of music from a prerecorded MIDI file. You can mix and match instruments and genres, and save your songs locally as Standard MIDI Files.

While the EMP Web site is full of eye candy, it's also focused on education for all ages. "I think the whole site is an educational experience," commented Zoe Melendez, special projects

Fig. 2. *Within World Jam, visitors can create music online in the Mixing Room. Here, you can mix and match instruments and genres (jazz, funk, fusion, reggae, country, rock, and pop), then save the songs to your hard drive as Standard MIDI Files.*

> "EMP is about giving people a chance to experience what it feels like to create music."
> —Zoe Melendez

manager for EMP. "It taps heavily into the content within the physical museum and its interpretive style. There's a lot of opportunity for learning about the history and culture of popular music, specific artists, and the creative process in general. We'll also be offering materials, like curricula, to educators via the Web. For example, our current curriculum is Rock 'n' Roll School Tools, which was developed for a temporary exhibition we did in conjunction with regional educators. It's a four-lesson-plan model that explores the early blues, history of Northwest music (Seattle Sound/grunge), the invention and evolution of the electric guitar, and women in rock.

"Our goal is to use computer technology to make the experience of creating music as good as it can be, but we're not about using technology just because it exists. We're really about giving people a chance to experience what it feels like to create music."

Fig. 1. *In the Guitars portion of EMP's online music museum, visitors can hear what certain vintage guitars sound like by rolling over the strings with their mouse. Deeper pages reveal the history and specifications for a variety of guitars, in addition to audio files from key albums on which these instruments were used.*

Stephen Marinick

Shameless Sound Scavenger

How many times has your motivation to make music been squashed by the sinking feeling that you just don't have enough equipment to get the job done right? Sadly, this kind of despair isn't uncommon among recording musicians. People who start out with big aspirations can end up dwelling on tools they don't have, and never get around to writing any music.

Overcoming this kind of challenge is a theme that underscores each issue of *M&C*, which is why reader Stephen Marinick is an obvious choice for the spotlight this month. Using his Mac PowerBook Duo 270, a 4-track cassette recorder, a few dated MIDI instruments, and a police scanner (no, that's not a typo), he's able to crank out guitar-driven industrial tracks that you might mistake for a professional studio recording. His solo project, Hooks For Hands, takes a found-sound approach to songwriting, and serves as a creative outlet from his full-time free-lance graphic design work.

Going Solo. Though Hooks For Hands operates on Stephen's terms, it wasn't always so. As he explains, "The project actually started back in '91. I had been playing guitar in lots of different hardcore punk bands during the mid- to late '80s. I was working with other local musicians, each of us playing our own instruments, but we shared the drum machine programming and sequencing duties. That's when I first got introduced to MIDI technology, by using our keyboard player's Ensoniq ESQ-1 work-station [synthesizer with built-in MIDI sequencer] and Mirage sampler."

It didn't take long before creative differences began to surface, which led to a restructuring of the band. "I'm a big fan of guitar players, and at the time I was into heavy metal bands — not the long hair, operatic thing, which I considered to be silly, but music like Metallica's early stuff with all that crunch. I've always had in mind some sort of fusion between the heaviness of that sound and electronic music. Ultimately, what always seems to happen with bands started to happen to us. Every member had a different idea of what we should sound like, so Hooks For Hands dissolved after a while. The name was my idea, though, so I kept it, along with a few

leftover tunes that didn't really go anywhere with the band. At that point I regrouped and started experimenting on my own. That's when I got the TASCAM Porta Two 4-track. It was the start of my being able to put different sounds together and write songs by recording individual parts instead of sitting down with a guitar and banging them out. Shortly thereafter, I bought my own ESQ-1. At first I was sequencing simple, heavy synth lines and messing around with guitar tracks over that. Initially, before I had a drum machine,

> "I've always considered myself a songwriter first, but the Internet has changed how I do that."

By John Krogh

I used whatever I could find around the house for percussion."

With the sequencing and recording skills he learned from working with his ESQ-1 and 4-track recorder, he began to shape the sound and songwriting style of Hooks For Hands. "I gradually started writing more songs, all along having a pretty focused idea of what I wanted this thing to sound like. I've always been a fan of the harder-edged, heavier sounds of earlier punk bands like the Ramones and the Sex Pistols, along with Skinny Puppy and Cabaret Voltaire."

While you can certainly hear Stephen's influences manifested in Hooks For Hands, he's worked hard to create his own sound, which is built on a solid foundation. As he explains, "Early on I started experimenting with different combinations of sounds that I heard in my head. One of the first things I did was borrow a friend's Fender P-bass and sample its open *E* and *A* strings through my [Tech21] SansAmp [distortion box] into the Mirage. I combined that with live guitar parts and crunchy guitar samples. There's something about that combination of electric guitar and P-bass that I fell in love with — it pretty much became part of my core sound. I also started layering different drum sounds together in the [Alesis] SR-16 drum machine to create a 'super' drum kit. Basically I combined all my favorite percussion sounds, like a gated electronic snare with a finger-snap tucked underneath, or a kick drum with a bit of tom ring, until I had a library of thick drum textures."

During this time, Marinick was also busy developing his computer chops working as a freelance graphic designer. Getting his head around a computer interface and operating system prepared him for the challenges of desktop music making — an approach to songwriting that he hadn't yet explored. In fact, it wasn't until he logged onto the Internet that his fascinations with music and computers came together.

Through the Internet, he was able to scavenge for used gear and software and talk to other musicians who shared common interests — in short, he discovered a larger community of musicians. "I've always considered myself a songwriter first and foremost," he notes, "but the Internet has changed how I do that. My entire MIDI studio is made up of bargain-basement deals, and the Net has played an important role. For example, I purchased my sequencing software — a second-hand copy of [Passport] Master Tracks Pro — and an Opcode MIDI interface from the Net. I just put the word out and started talking to other people who were using older Ensoniq gear, which lead me to so many finds."

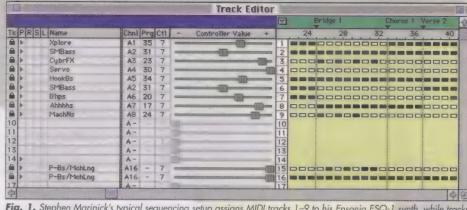One such find is a Pro 43 radio scanner that's been modified to pick up cellular phone

calls. You might not think of scanners when it comes to music, but as far as Marinick is concerned, nothing is off limits in the search for new samples. He describes his found-sound technique as the result of combining different influences.

"I listen to lots of different sample-based music and spend way too much time on the Internet reading Usenet or anything else that interests me. One day I was reading one of the scanner newsgroups and started to understand what people were able to do with this technology. It sounded like something that would allow me to capture some fresh audio. So, like I do with everything else, I waited it out and watched for the right deal on a Pro 43. When the price was right, I picked one up. Since then, I've spent way too many all-nighters developing an audio archive of weird phrases and sounds."

When we asked him to share a juicy phone sample that he's used, he declined, saying only that he's "certain unsuspecting callers would feel a bit unsettled to know that people are randomly tracking their phone calls. In fact, I never say anything on a portable or cellular phone that I wouldn't want people to know."

The Process. Stephen doesn't just write songs, he creates walls of sound filled with heavy guitars, punchy drums, and scathing vocals. The sound he's able to achieve with his modest studio setup is amazing. "I usually start by working with my guitar and a book of lyrics that I keep around in case inspiration hits," he reveals. "From there I'll get a few fundamental parts together — like guitar lines and basic drum patterns — that will form the basis of a song. Next I start looking for appropriate sounds to fill out the skeleton by listening constantly, watching TV or movies, and pulling audio from other places. Mostly it's a matter of each song having a feel and trying to pick samples and sounds to complement that. Then I'll do more involved sequenced parts in the computer." (See Figure 1.)

Live and sequenced tracks get recorded to his 4-track with some compression. These tracks get mixed down and recorded into his Power Mac 8500 running Macromedia SoundEdit 16 digital audio recording software. Once the core of a song is inside the Mac, samples are pasted in, and rhythm guitar parts are doubled. The vocals are recorded last, with the background vocals being pitch- and time-shifted to get a shouting chorus effect. For final mixdown, all of the songs are re-EQ'd and recorded to cassette tape.

Though Marinick has a Mac 8500, which could easily run processor-intensive music software, he chooses to use a behind-the-times laptop and fairly basic software for most of his music. His reasoning is easy to understand. "It's important to realize that music is my creative outlet. It's what I do for *me*. So I usually work on it while the 8500 is locked up rendering 3D animation or whatever. That's why I use lower-end software, because I can run it on my tiny, old, weak computer without too much hassle. Plus, I'd have to work a lot harder to afford higher-end equipment, and if I did, I wouldn't have time left to make music, which defeats the whole purpose of why I do this in the first place."

The Future. Stephen is currently putting together a collection of songs for a future CD that he'll sell via his Web site. Of course, he's on the lookout for new tools to enhance the quality of his recordings. "I'd like to stop using the 4-track altogether and be able to go directly to my hard drive via some type of multitrack digital audio card. With the Hooks For Hands cassette, I just went straight from 4-track to computer through a mini-plug input. Ideally, I'll pick up a CD-ROM burner and make my own CDs from start to finish. Unless I win the lottery, though, I don't see myself buying a bunch of new gear — but that's okay. I think the equipment that I have has really helped me develop a unique character to my music." 🔊

Contact: *Stephen Marinick/Hooks For Hands, 4620 E. Monterosa, Phoenix, AZ 85018; 602-954-9140; e-mail: stevem@primenet. com; Web: www.marinick.com/hfh.html.*

Fig. 1. *Stephen Marinick's typical sequencing setup assigns MIDI tracks 1–9 to his Ensoniq ESQ-1 synth, while tracks 15 and 16 trigger sounds on his Ensoniq Mirage sampler. The Mirage samples range from a Fender P-Bass note to dialogue grabbed from movies, TV, or phone conversations. Incoming MIDI controller data is usually assigned to control volume, letting Stephen fade sounds in and out. The sequencer is Passport Master Tracks Pro.*

The sun has set on the Oakland Coliseum in California, and thousands of U2 fans have gathered to bear witness to one of the biggest arena shows in the history of rock — PopMart. A single golden arch, reaching beyond the top of the stadium, stands in front of a 50 x 170-foot shopping-cart-shaped video screen. Video clips are splashing across the screen every few minutes, teasing the audience while crew members scurry to make last-minute preparations. Suddenly, the stadium lights dim. Moments pass before a drum loop breaks the hum of conversation. Cheering starts near center stage, but the house is still dark.

Just then, the screen explodes in a fury of blue and red, illuminating the stage for U2 as they launch into the electronica-influenced song "Mofo" from their new album Pop.

Clearly, U2 has come a long way since their Dublin pub gigs of the late '70s. Today, the band's entourage consists of 15 buses, 72 semi trucks, and 265 permanent crew members, with an additional 400 to 500 local workers at each stop on the tour.

To say U2 has evolved is an understatement. In the '80s, they hit with a guitar-driven anthem rock sound immortalized by such sing-alongs as "Pride (In the Name of Love)" and "Where the Streets Have

U2 Live!

The Computer Beh

By John Krogh

uters
ind
PopMart

No Name." They reinvented their sound for *Achtung Baby*, which was released in '91 and sold more than 10 million copies.

For the last 11 years of their development, Des Broadbery has been lending his expertise as a synth/computer programmer both onstage and in the studio. *Music & Computers* caught up with Des before the first of two shows at the Coliseum to discuss what went into preparing for PopMart. Following the show, we cornered him for a Q&A session in the Underworld (see "In the Underworld" on page 37), where he holds court over four giant stacks of MIDI and computer equipment.

Prepping for PopMart

To understand Des's role on tour, it's important to realize that U2 has always been about forward motion. In fact, Bono, the band's lead singer, has been quoted as saying that "music can't sit still, otherwise it's folk music, and I don't want to be in a folk band." Incorporating changes into a live show is one thing for a singer, but when you're piloting a complex MIDI rig, making even simple adjustments can be precarious. Programmers usually spend weeks gathering multiple versions of samples, creating alternate patches, etc., so as to be prepared in the event that a last-minute change is needed. In the case of PopMart, Des started his preparations while the band was still in the recording process for *Pop*.

"It was a whole different approach that we took for this record," he says. "Very different for me. The last album, *Zooropa*, was a completely mental album for me. I played a lot of parts on it, but on *Pop* I didn't play so much. At the initial stages, I prepared by getting loads of samples, mostly loops and short phrases, anything that sounded interesting to me. I organized and stored them to be used later in the studio rehearsals.

"Then we went off to France for about six weeks. I pulled up the samples and patches I'd been working on and got a few little vibes together in [Opcode] Studio Vision [MIDI sequencer/audio recorder], which the band would play to in rehearsals. After that, we came back to Ireland, where [DJ and mixing engineer] Howie B, [remixer] Nellie Hooper, and other people were waiting to go. Once everyone on the production side got involved, I could relax and not have to run around so much. The boys also wanted to try out other programmers they met in the interim of making this album, which gave me a bit of a break."

Once the album was finished, Des focused all his energy toward the live show. "I started by listening to the final studio recordings and followed along with a special track sheet that showed me what parts lie where within the bar count," he explains. "I could look at it and say, 'Okay, this guitar hit comes in here and the percussion loop starts here.' Next, I decided which songs would start with a basic click and which ones would start with drum loops. Then I formed sequenced tracks as I went, based off of these sheets, and eliminated what I didn't need, like all the parts that would be played live.

"It was at this point that I went back to the samples I had already created for the record and made more from the final recordings. We brought in a guy named Dave Clayton to help with this. During the day, he would be in one room programming songs for the next day's rehearsal. I'd take what he had done each day and work on it at night. We had things flowing like an assembly line, but in the beginning it was hell. The way we constructed those sequences is similar to how a remixer keeps adding tracks and gets a composite sound in the end."
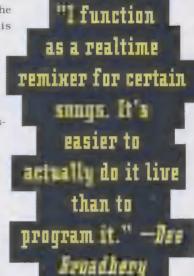
To make matters more complicated, Des had to set up and tear down several times during the

> "I function as a realtime remixer for certain songs. It's easier to actually do it live than to program it." —Des Broadbery

rehearsal period. "We started in the band's own studio in Hanover Key, Ireland. From there we took it to the Factory, which is a space in Dublin. We took three rooms there for full production rehearsals. Eventually we moved out to Las Vegas for another two weeks of final production. By then I had three people working underneath me and it was a nightmare. I was going home when the sun was coming up and going back to work when the sun was still coming up. It's all sort of a blur in my mind because I was working so hard and wasn't keeping track of time. I had only one date in my mind — April 25th, the show's start date."

With a set list of over 25 songs (see Figure 1), which can get moved around and rearranged on a show-by-show basis, the last thing Des needed was a problem with his sequencing software.
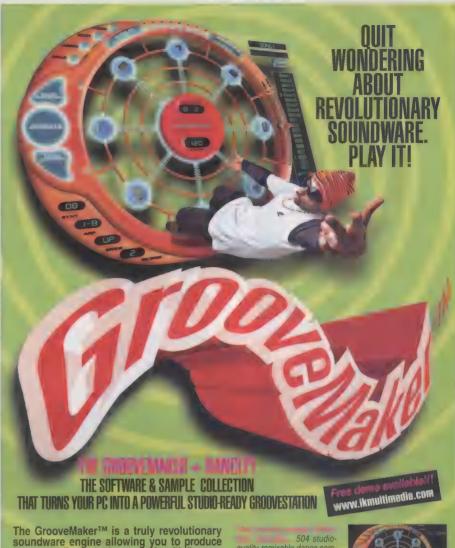
Fig. 1. *PopMart crew members receive a printed set list (right), but Des still relies on his hand copy (left), complete with reminders along the side.*

"Because of the number of songs we were using and jumping between, we ran into serious memory problems in Studio Vision. We had gotten so far with most of the sequences, most of the arrangements were done with bass lines, loops, and effects. Then everything died and went away!

"There were problems that Opcode didn't understand, because I was using Vision and Max [realtime MIDI processing and graphic

programming software] with each other in a way that they weren't used to. It was pretty hellish, because I thought we had lost three weeks of work, but we were able to recover it. We ended up dropping sequence files to each other back and forth over the Internet, and we'd talk nearly every day. They would work on a new version of Vision and send it to me — basically, we worked the kinks out together."

Amazingly, Des hasn't experienced a single crash since the start of the tour. Now that his system is trouble-free, he's taken the approach that if it isn't broke, it's best not to mess with it. "So far, everything seems to be working just fine. But I'm not about to go chasing down newer versions of anything for a while, at least until after I'm done with this [tour]."

Post PopMart Q&A

As fans filtered out of the stadium after the show, M&C waded through empty seats toward the golden arch in the sky. After we reached the stage and explained to security that we really were supposed to be there, they led us underneath the stage, where we met up with Des. Here's what he had to say. . . .
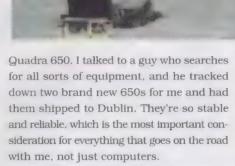
Since PopMart looks and sounds so produced, I would think that everyone behind the scenes would be running top-of-the-line Power Macs, but you're using four-year-old Quadra 650s to drive your end of the show. Why?

Well, there's a real good reason for using those. When I was getting ready for the Zoo TV tour, I researched the most reliable Mac on the market and it ended up being the SE/30 [a 16MHz 68030-based machine that came out in 1989]. So I got two of them and had them racked by a company called Current Music Technology. This time out, the SE/30s wouldn't work. They couldn't handle all of the unique routing needs that we had. The computers would start to slow down and eventually stop somewhere during the run-throughs.

So I started researching again and I found that the best music computer is a

Quadra 650. I talked to a guy who searches for all sorts of equipment, and he tracked down two brand new 650s for me and had them shipped to Dublin. They're so stable and reliable, which is the most important consideration for everything that goes on the road with me, not just computers.

That's how I picked which synths to take out. Reliability was at the top of the list and flexibility came second. Obviously it all has to sound good, but the whole rig was put together to be very flexible.

Are the two 650s running together?

No, they're not working together at all. One is a backup in case the other goes down. Basically, if one crashes or stops, I switch to the second Mac and pick up from the next available section in whatever song,

then continue on. The second computer doesn't track or chase anything; it just sits there, booted up in case I need it.

We took the songs and broke them up into pieces like choruses and verses. In Vision you can insert markers for each of these sections, so all I have to do if I need to switch computers is go to the next section in the song's sequence and wait for the boys to catch up. At that point, I cue the sequence manually.

Do you use Vision's cue functions, then?

We're not exactly using the cue feature. It's similar to how Vision does that, but it's being handled by a patch that [programmer] Tony Widoff wrote for me in Max. [See "Max Meets U2" on page 31.] How it works is that the band can have a song that might just be percussion up until a certain point, and then it might go into a middle eight or

Max Meets U2
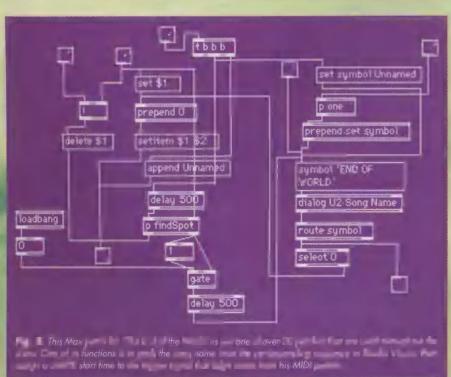
Most MIDI sequencers are capable of handling the editing and file management tasks you would typically need for a recording session. But for routing MIDI signals from multiple controllers, and allowing for the kind of on-the-fly changes that you might want in a live performance, sequencers sometimes fall short. High-end MIDI interfaces help by letting you create preset routing configurations that can be recalled from your sequencer, but sometimes even this isn't enough.
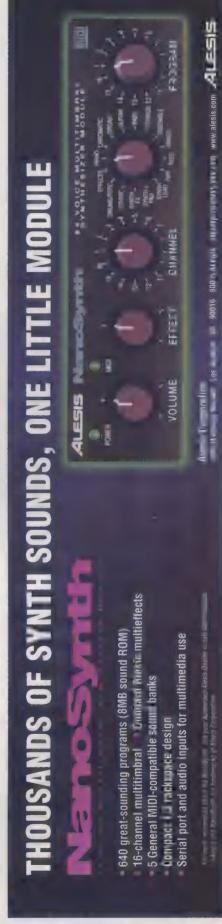
To cover the unique routing (see Figure 2) and video sync requirements of Pop-Mart, Des Broadbery uses a realtime MIDI processing program called Opcode Max (profiled in the Sept/Oct '96 *M&C*).

Programmer Tony Widoff, who designed the Max patches for U2's Zoo TV tour, was brought in to squeeze the most out of Des's updated MIDI system. As Tony explains, "We had to change Des's system this time around because all of a sudden the [Opcode] Studio 5 MIDI interfaces behaved a little differently than they did for the Zoo TV tour. What we ended up doing for PopMart was having the main Studio 5's

MIDI outputs connected to the various devices in Des's racks, and all of the MIDI outputs from the backup Studio 5 plugged directly into the corresponding inputs of the main Studio 5. In the event of a crash, he only has to call up a thru patch on the main unit to allow incoming MIDI from the backup unit to pass. Then he can run the show as normal from the backup Mac."

The PopMart Max patches that Tony created serve two primary functions. First, Max is used to generate SMPTE timecode through the main Studio 5. (SMPTE timecode is a synchronization signal developed by the Society of Motion Picture and Television Engineers for locking video or film and sound together. It specifies time in hours, minutes, seconds, and video frames.) Second, Max lets Des associate a unique trigger value with each song name in Studio Vision. These values get sent from the Roland K-5 MIDI pedals that Edge plays onstage, which allows him to trigger a sequence that acts as a transition (like the bridge or solo section) within a song. An additional SMPTE timecode value is associated with this trigger

Fig. 1 This Max patch (Fig. 1 of the patches) is one of over 20 patches that are used throughout the Zoo TV. One of its functions is to provide the song name that the programming sequences in Studio Vision. Another is to assign a start time to the trigger signal that Edge sends from his MIDI pedals.

U2's PopMart

in case the video director wants to make the most of the transition.

"But for the purpose of the U2 show, all they needed was a solid burst of timecode at the top of each song to facilitate simultaneous starts for audio and video teams," Tony adds. "After that, everyone gets to play their roles somewhat autonomously."

Tony also added a few finishing touches in Max that add to the ease of use and safety of running such a complicated setup. As he explains, "There was some concern about an inadvertent retriggering of a start/stop command, which might pause the sequencer in the middle of a song. When things get a little enthusiastic

Fig. 3. Programmer Tony Widoff included a safety feature that would disable Edge's MIDI pedals from sending start/stop commands after a preset amount of time, in this case two seconds. Here's the Max patch for "MoFo." Notice the inactive Studio Vision window. Its Key column shows the keystrokes that Des has set up to trigger each of the sequences in the show.
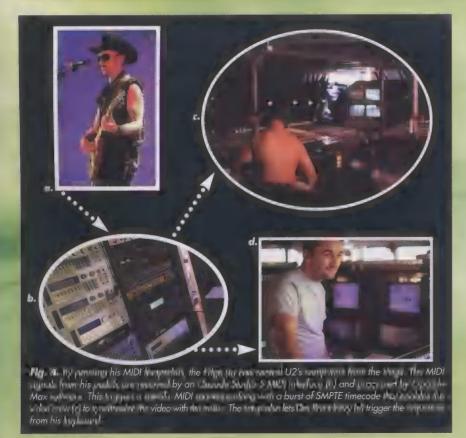
or out of control onstage and there's a lot of dancing about going on, you never can tell when an errant limb may plant itself firmly on the wrong switch. I wrote a feature that would allow Des to specify how long Edge's foot pedals will remain active after the start command is sent." (See Figure 3.)

Figure 4 shows how it all flows: Edge sends a MIDI command from his Roland pedals to the main Studio 5, which then starts sending SMPTE timecode to the video crew while at the same time sending a start command to Studio Vision. The Max patch also allows Des to trigger the sequences by playing a key on his keyboard. ◀𝄞

Fig. 4. By pressing his MIDI keypedals, the Edge can command U2's computers from the stage. The MIDI signals from his pedals are received by an Opcode Studio 5 MIDI interface (a) and processed by Opcode's Max software. This triggers a burst of MIDI commands along with a burst of SMPTE timecode that enables the video crew (c) to synchronize the video with the music. The last patch lets Des (that's him) (d) trigger the sequences from his keyboard.

a solo. I can press a key that tells the sequencer to cue the next part of the song so that it falls in on time. [See Figure 3 on page 33.] It basically gives them the freedom in the first or second half of a song to run around and be as open as they want to be. They can have long sections, short sections, whatever.

I have a cue point within the vocals or drums, for example, to go onto the second half of the song, and that will come in on time. [Ed. Note: See "Computers Come Alive" in the Sept/Oct '97 M&C for more on how Vision's cue functions can be used for live performance applications.]

Are any of these cues dependent on instructions from the video crew?

No. In fact, I'm the master sync source. All I do is send timecode to them and they take it from there. That's all written into the Max patch.

During the show I noticed a few parts that weren't on any of the albums. How do the live versions of songs differ from the studio recordings?

Obviously, the band makes these decisions, but arrangement-wise, some of the changes are made purely because some songs work better live with a particular arrangement. Plus, a lot of stuff on *Pop* is live. Many times while we were working on the album, we thought, "This song will be great live!" We were thinking about the show while we were recording the album.

There are some songs on Pop that are more electronica-oriented, like "MoFo," for example. Did the band look to you for help with these songs, since one of your specialties is programming?

Well, with that song in particular, the version they ended up using on the album happened almost by accident. It came out of a jam. Originally it was a very structured song. Now it's run pretty much free-time. I end up having to mute parts and fade things in and out for the choruses and verses.

So you function like a realtime remixer for certain songs?

Yeah. Muting and fading mostly. Like in "Please," I mix the strings in, things like that, depending on the mood. Same thing for "Streets" ["Where the Streets Have No Name"]. It's easier to actually do it live than to program it, so I just do it myself for each show.

Do you consider yourself a sideman, then?

I'm a keyboard programmer.

It seems that you have some creative input with songwriting and the band, though.

Figure this the way you want. Let's say the boys wanted to go off in six weeks to start a new album. I would go off for a couple of weeks and pull in some loops from anything I could find. Then I'd program up some short loops, jams, jingles, whatever. After that I'd play them for the band, and from that audition process they'll start the songwriting. We would do the basics with [guitarist]

U2's PopMart

Edge and [singer] Bono, or [bassist] Adam and sometimes [drummer] Larry. It's all very loose, there's no set way that they do this.

It sounds very jam-oriented.

For sure. It's all about choices — having a lot of sequenced and sampled material on hand, ready to go. I'll grab bits and pieces from CD-ROMs and other places, but lately a lot of the samples we end up creating ourselves. Programming sounds and loops with maybe five different versions: different effects, delays, and mixes. Then we'll make loops out of them and that'll be that.

Larry has done many of the loops. I've sat with him for three or four weeks at a time and come up with live loops, or sometimes he'll make loops using sounds from the [E-mu] Procussion [drum sound module], or whatever we have on hand. We'd lay those down onto DAT [digital audio tape] and leave them for later on.

A lot of the loops on *Pop* came from Larry playing live, actually. Some of them came from Howie B and some of them are mine. We're not locked into using anybody's particular software or method of doing things. We're very open-minded to everything, so there's a lot of different things
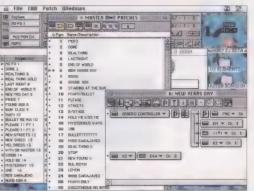
Fig. 5. Each song has its own Studio Patch, which is a preset routing configuration for the Studio 5 MIDI interface. This patch for the song "New Year's Day" shows how MIDI signals are routed from Edge's Fatar "generic" MIDI controller and Des's Kurzweil K2000 to four different devices in the Underworld.

going on all the time. There are no set rules — anything that can help, we use.

Ever Since Achtung Baby [1991], MIDI technology has played a noticeable role in developing U2's sound. Does the band interact and relate to you on a technological level, or do they understand how any of this works themselves?
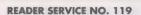
It's a nightmare. [Laughs.] Actually, Larry and Adam came over to the U.S. for a while to learn how to [sample and sequence] themselves. What I have to do is on a whole different scale compared to what they were dealing with. I think what they learned, though, is that it takes time

> **Larry and Adam came over to the U.S. to learn how to [sample and sequence] themselves. I think what they learned, though, is that it takes time to do this.**

In The Underworld

E ach night as U2 takes the stage, Des Broadbery descends into the Underworld, a station beneath the stage where his three racks of MIDI and computer equipment reside. From here, he communicates with crew members and keeps visual contact with drummer Larry Mullen, who is fed three audio lines from Des's system: a main click track, a backup click in case the samplers crash, and percussion loops that were sequenced just for Larry to hear and play off of.

Toward the last half of the show, the band is transported to the B stage inside a giant lemon-shaped disco mirror-ball. Des keeps a close watch on the lemon from his video monitor during this section, and triggers samples in real time to a DAT tape of spacey sustained sounds until the band is in place. Dressed in Village People-esque costumes, they emerge from the lemon and kick into the butt-shaking "Discotheque."

RACK A
Three Akai S1100 samplers (32MB)
Akai S3200 sampler (32MB)
E-mu Procussion sound module
Two Iomega Zip drives
Iomega 1GB Jaz drive
Speck Electronics Extramix 40-channel
   line mixer

RACK B
Furman power distributor
MOTU Video Time Piece MIDI
   interface/synchronizer
Two Opcode Studio 5LX MIDI interfaces

PG 37 + 38 PHOTOS: **MARCUS HANSCHEN**

Continued from page 36

to do this. Sometimes things can't get done instantly — that's just the way it is.

Looking at the stage, I noticed that the Edge's MIDI pedals are tied into your rig down here. What does he trigger?

He's playing some Roland pedals. They're set up as an incoming instrument into the [Opcode] Studio 5 [MIDI interface/processor]. Each song has a different Studio Patch [see Figure 5 on page 36] that routes him through to a synth or sampler, or triggers sequences. Some of his guitar samples end up on me, though. There are some guitar parts from the album that are hard to recreate live, like the screaming, full-volume tracks, which are impossible to do onstage.
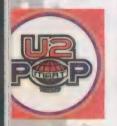
It looks like you have good eye contact with everyone on stage from in here. What do you do for the segment of the show when

In The Underworld

Continued from page 37

Drawmer noise gate
Novation BassStation synth module
E-mu Orbit synth module
Roland Super JV-1080 synth module
E-mu Emulator E4x sampler (128MB)
Alesis D4 drum module
Korg A2 effects processor
Yamaha SPX1000 effects processor
Fostex D5 DAT deck
Two E-mu Emax II Turbo samplers

MAC RACK
Two Apple Macintosh Quadra 650s
Laney LC 15 keyboard amp

TASCAM DA-88 digital multitrack tape recorder

MAIN DESK RACK
Mackie 32-channel 8-bus mixer
Nord Lead synthesizer keyboard
Kurzweil K2000 synth/sampler (32MB)
Yamaha DX7 E! synth
E-mu Proformance/1 piano module
Roland MC-50 hardware MIDI sequencer
Yamaha PD2500 power amp
Four BSS rackmount direct boxes
Turbo Sound Impact 8 speakers
JVC video monitor

ON STAGE
Roland K-5 MIDI pedals
Fatar 610 Plus MIDI controller keyboard

the band goes out front to the B stage?

During that I'm running clicks for "Discotheque" that go to their in-ear monitors. I play some keyboards during "Velvet Dress," and I'm running some loops and keyboard parts for "With or Without You." I have my own video monitor that I watch them from when they go out to the B stage. I keep in close contact throughout the show with Larry mostly. I tell him what's going on and what I'm doing, because he's the one who listens to the click through the entire show. Edge will be informed about what has to be done if I'm changing something. He just says, "Go and fucking do it," and keeps playing. [*Laughs.*]

Do you listen to playbacks after each show?

Every now and again we have a listen to a tape of the show, just to make sure everything is sounding okay. In fact, I have to make some changes before tonight's show based on a listen we did recently. I'm going to change the piano sound for "Mysterious Ways" because Howie decided that it sounded a little dull. Also, in general, some of the low end that comes from me has to be curtailed.

You've been on this tour for a while now. Do you have a favorite part of the show?

Whew, that's tough. "Streets," probably, 'cause it gets 'em going. I also ended up using a remixed version of it that I did, which was based off the live recorded version. I revamped it with bits of Edge's guitar part and we do it all live. The whole show is pretty fun, though.

Speaking of your involvement in the studio, do you prefer touring or recording?

Each have their own challenging elements. It's tough on either side. I've been in the studio from 11 in the morning until 3 in the morning. Likewise on the road. Creative-wise, being in the studio is a lot of fun. You can throw things out in the air . . . I think I would rather be in the studio. Also, you get to be at home when you're in the studio; you're not a nomad like I am now.

In all your time on tour with the band, what's been the biggest lesson you've learned?

Bring a second computer *always*. That way you're only down for one song at the most. By having two, I'm given the security of knowing that I can continue on with the show and not worry about what's just happened if something goes wrong. For as many problems as they can cause, computers do save you.

PHOTO: **EBET ROBERTS**

How to
Mangle
Music with
Playlist
Software

By Craig Anderton

S omewhere between listening to music and composing music, there's playing around with music. Maybe you're into downloading MOD files from the Internet, or altering Standard MIDI Files. Or maybe after reading the "Fun Music Software" issue of *M&C* (July/Aug '97), you went out and bought something like Aesthetic Engineering's Music Mouse or Hotz's Hotz Trax, which let you make music without having to climb a steep learning curve.

But what if your tastes in music tend more toward remixing and dance music? I'm glad you asked — because this article is all about taking an existing song from a CD, transferring it to a digital audio editing program in your computer, then de-constructing and re-constructing it in various ways. The process is sort of like collage, except you can't glue your fingers together accidentally. Best of all, in the process you'll not only have fun, you'll also learn a lot about sound, music, and digital audio editing.

How to Mangle Music with Playlist Software

Meet the Playlist. It may seem like we're going to get into the ol' "cut and paste," but we'll be doing something quite different. Cutting and pasting are *destructive* editing processes, because these operations physically alter the original audio file to create the edited version (although an undo function can restore the original file if needed). This process of rewriting a new, edited file to your hard drive takes time, which is why after doing something like a cut, you have to wait for the computer to catch up.

Non-destructive editing, our technique of choice for this application, offers three big advantages. First, it leaves your original file intact, so if you blow things big-time you can always get back to square one. Second, it avoids the rewriting-to-hard-disk process, allowing you to make edits that are virtually instantaneous. And third, it lets you keep multiple versions of a file handy with virtually no additional disk space. There are a variety of non-destructive editing options in different pieces of software, but we're going to concentrate on the *playlist*.

A playlist is a list of digital audio *regions*. A region is a section of the tune you select, such as a measure, a single beat, a chorus, or whatever strikes your fancy. As an example of one basic playlist application, suppose you wrote a song with a four-measure introduction, and you now want to stretch the intro to eight measures. No problem. Define the entire song as one region, the four-measure introduction as another region, then create a playlist that lists two regions: the four-measure intro and the entire song. When you play the playlist, it plays the four-measure intro (region 1), then jumps back to the beginning and plays the entire song (region 2).

Want to extend the beginning another four measures? Simply add another entry to the playlist specifying the four-measure intro region.

Fig. 1. *It's easy to pick out the beats in this recording of the Macarena because the kick drum hits on every quarter-note, producing a sharp transient. (We've highlighted the transients with red lines.) The screenshots in this article were produced with Sonic Foundry Sound Forge (PC), but the techniques discussed should work on any program that offers playlist editing.*

(Alternately, some software lets you specify a particular number of repeats for a given playlist entry.)

For dance music, you can place individual regions in the playlist and repeat them *ad infinitum* (or *ad nauseam*, depending on your intended result), shuffle different parts of the song around so that the cool solo becomes a cool intro, and then convert the whole mess into a new file. Once you start fooling around with this technique, you'll be amazed just how different a tune can sound once you start rearranging it. This is definitely fun stuff, but if you want to get more serious, you can. I regularly create playlists for overly long songs to trim the flab and repeat the good bits.

Mutilating the Macarena. I decided to base this article around an actual song,

Fig. 2. *Here we've zoomed in on the beginning of a downbeat. The percussive transient is highlighted in blue.*

so new folks can follow right along (although with a tiny bit of imagination it's easy to understand how to apply these techniques to other songs). And what better choice than the Macarena? First, it sold a zillion copies, so odds are somebody you know has a CD sitting around with it. The version we'll be using is by Los Del Mar, which is on several compilations, including *Super Dance Hits '96* (Popular/Critique, 50 Cross St., Winchester, MA 01890). Second, everybody claims to hate the tune, so mutilating it seems like a worthwhile endeavor. Third, once you cut out the obnoxious "Hey Macarena" part you've heard until you were ready to scream, you'll find there are some cool little riffs in there — sort of Bo Diddley meets New Order, with a side of Soca. Or something like that.

Our software of choice will be Sonic Foundry Sound Forge, because it's pretty ubiquitous. But if you're a fan of Digidesign Sound Designer or BIAS Peak on the Mac, or various other digital audio editing programs, rest assured that the process of creating and arranging playlists is pretty similar from one program to another. What we'll cover here is relatively universal.

Getting Started. Record the song onto your hard disk using your digital audio software; start recording a few seconds before the tune's actual beginning to make sure you get the very first kick-drum downbeat. If you want to follow along with the

How to Mangle Music with Playlist Software

Fig. 4. When you drag a region of audio to Sound Forge's Regions List window (at right), a dialog box opens, allowing you to name the region. This is the first step in creating a playlist.

article, you'll now need to delete this dead space from the beginning of the recording. (Use your software's Trim/Crop command for this.)

Dance music is very easy to work with because there's almost invariably a constant kick drum hitting on every beat. This makes it easy to see where beats begin, and simplifies finding measures. Figure 1 on page 44 shows the first few seconds of the tune; the red lines (drawn in for clarity) show the beginning of each beat. Figure 2 on page 44 zooms in on one of the downbeats. Note how there's an obvious percussive transient (highlighted in blue) that signals the precise start.

To get a feel for what a region will sound like when repeated, skip the first four kick drum hits, then click at the beginning of the fifth. Drag past three more kick drum hits. Stop right at the beginning of the next one. (See Figure 3.) We've now selected a measure. Play it by clicking on the Play button to confirm that it is indeed one measure; if not, drag the measure boundaries until the region is one measure long. (In Sound Forge, you can drag these boundaries in real time, and the program will take the changes into account on the next loop.) For the tightest possible timing, zoom in and place the cursor right up against the kick

drum transient, as in Figure 2. Now click on the Play Looped button and the measure will repeat.

Collecting Your Regions. To start the playlist process, first we need to decide which regions will make up the playlist. Go to the View menu and select Regions List; a window appears. To add the selected region to the list, simply click anywhere within the region, then drag it to the Regions List window. A dialog box appears that lets you name the region, and shows the start and end points, as well as length. Figure 4 shows the dialog box on the left, and the Regions List window on the right. (Note that you can click on the dialog box Play button to audition the region, or enable the Play Looped check box to audition the region in loop mode.) As soon as you click on OK, the dialog box disappears, and the named region appears in the Regions List window. (There are other ways to define regions, but this is quick and intuitive. For more information on creating regions, check your software's manual.)

Now it's time to grab more regions as raw materials for our collage. Click at the beginning of the 13th kick drum hit (the beginning of the fourth measure) and select one measure (i.e., four kick drum hits total). Drag it to the regions list, then select the next four measures and drag them to the regions list as well. We now have three regions in the list (the entire song may also be in there as a default region). While you're at it, grab four measures somewhere before the verse comes in.

Number-Crunching. Let's get a little more complicated. Play the song through until you hit the part that goes "Heeeeey Macarena." We're going to take the one beat that makes up "Hey" and not take the part of the measure that says "Macarena."

This is a little more complicated because the vocals cover up the nice distinct kick drum hit. If you zoom in real close, you may be able to recognize the transient that makes up the kick hit, but you may not. Yet it's important to grab a section that is precisely one beat long, or the tempo will get weird when we work this region into the rest of the playlist.

The solution is to first find the length of a beat. If you look at the regions list window, you'll note that each region has an indicated start and end time. Subtract the start from the end to find out the length of a measure in seconds. In this case, a measure is 2.325 seconds long. Therefore, a single beat would be 2.325/4, or 0.581 seconds. (You may get more accurate results by timing eight measures and dividing by 32.)

Click at the beginning of the "Hey" and drag until the length indicator (highlighted in green; see Figure 5) shows 0.581 seconds. Drag this region to the regions list, and name it something like "Hey 1 beat."

Fig. 3. Note the four evenly spaced beats in the highlighted region. This represents one bar of the song.

While we're here, move the right locator leftward until the length indicator shows 0.290. This region is now one eighth-note long. Drag it to the regions list; a good name would be "Hey 1/8 note." For our final "Hey" operation, move the right locator toward the left until the length is 0.145 — a sixteenth-note region. Again, save this as a region and name it "Hey 1/16 note."

Why am I making you do this? Here's why.

Creating a Playlist. Let's take all the "Hey" sections and create a mini-playlist to get an idea of how this feature works.

Go to the View menu and select Playlist. This opens up the playlist window. To add entries to the playlist, drag over regions from the regions list, in the order in which you want them to play. In this case:

Drag "Hey 1 beat" to the playlist window.
Drag "Hey 1/8 note" to the playlist window.
Drag "Hey 1/16 note" to the playlist window.

However, we want each region to repeat several times. Double-click on a region name in the playlist; a window pops up with a "Play Count" parameter. In Figure 6 on page 48, "Hey 1 Beat" has a play count parameter of 4, so it will repeat four times. Set the Play Count of "Hey 1/8 note" to 4, and "Hey 1/16 note" to 8.

Now click on the small play arrow in the playlist window's upper left corner. This plays through the playlist — listen and groove! If you want to rearrange the region order, no problem. Simply click on it and drag to the new position.

Continue by dragging over other regions until you've created your Mutilated Macarena. You can drag these into place, or drag them anywhere and rearrange them later. If you want to copy playlist regions to use elsewhere in the playlist, select the region to copy, then right-click on it. A pop-up menu appears; choose "Replicate." This creates a duplicate playlist entry right below the one you just replicated. Drag the replicant to the desired playlist position.

Figure 7 on page 48 shows the final result — a version of the Macarena where the word "Macarena" does not appear at all.

Where Do We Go From Here? Now that you have your modified tune, you might want to save it as its own file for further processing. Right-click on the playlist, then select "Convert to New." Sound Forge will create a new file that pastes together all the playlist regions into one continuous file. Now you can do things like mix in sound effects, reverse one channel, fade in the beginning or fade out the end, add processing (like reverb, echo, or distortion), or whatever additional Macarena mutilations you might have in mind.

If you're still hungry for more shenanigans, mutilate another tune and create a file for that, too. Then create a playlist that plays these various files in order, thus creating your own way-cool dance mix. Sound Forge also has a new plug-in called CD Architect, so if you're really ambitious, you can burn a CD of your masterpiece. [Ed. Note: Selling copies of a CD containing someone else's recording

Fig. 5. Here we've selected a single beat of the song. As you can ▦▦▦ in the high-lighted box at bottom right, the selection is 0.581 seconds long. By dragging the right locator leftward until the display shows 0.290, we can define a region that is one eighth-note long.

How to Mangle Music with Playlist Software

recording a commercial CD or radio broadcast into your computer, mangling it, and then playing the results for your friends.]

The more you get into this, the more you'll notice creative opportunities. Thanks to playlists, I've taken some of the better

would be copyright infringement, and therefore illegal. But there's no law against
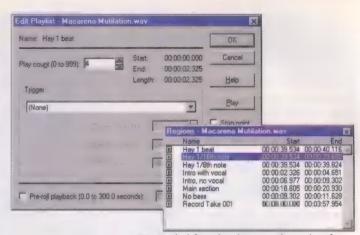
Fig. 6. *The left window determines the number of times an audio region in the right window will repeat. Here we've set the "Hey 1 beat" region to repeat four times, causing the music to last for a whole measure.*

Fig. 7. *The Macarena, mutilated. This version has been edited so that the word "Macarena" never appears. If desired, we can save the performance into a new audio file. Using playlist editing techniques to rearrange your own recordings is a great way to create new remixes and rhythm loops.*

rhythmic sections from my older tunes and created new rhythm tracks. After converting the result into a stereo .WAV file, I then close down Sound Forge and open up a digital multitrack program like SEK'D Samplitude or Metalithic Digital Wings for Audio, import the rhythm track, and add new leads and effects. This gets more into music creation than just fooling around with playlists, but hey, who's counting? Playlists are a good way to get your feet wet in the worlds of remixing and digital audio, so have fun and be creative. Who knows, you just may invent a new type of musical experience. ◀៳

Craig Anderton is the author of Home Recording for Musicians *as well as a regular contributor to* Guitar Player, Keyboard, *and* EQ *magazines. He lectures around the world on musical electronics, is a musician/producer with several major label CDs to his credit, and hosts the "Sound, Studio, and Stage" area on AOL (keyword SSS).*

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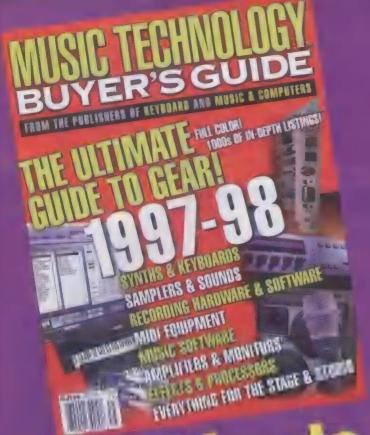
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wrestles her computers into submission

Wendy Carlos

The links between music and technology go back ■ long way. Eighteenth-century advances in metal-working gave violinists the brilliant tone of wire-wrapped strings. More recently, the changes brought about by electronics have opened up far broader creative vistas. And just as the violin needed a Paganini to show the world what it could do, just as the piano needed a Liszt to sweep away the cobwebs of harpsichord technique, electronic music technology needs visionaries. People like Wendy Carlos. ▰

By Jim Aikin

Wendy Carlos

Carlos has been using computers in her studio since the early '80s. Her upcoming CD, *Tales of Heaven & Hell*, was recorded on a pair of Macintoshes using Mark of the Unicorn's Digital Performer MIDI sequencing/audio recording software. But her love affair with technology goes back much further. In 1968, synthesizers were found in only a few universities, where electronic music was an arcane specialty taught only to graduate students. Carlos changed all that, almost single-handedly: Her landmark album *Switched-On Bach*, recorded entirely on an analog modular synth built for her by Robert Moog, became the first classical disc in history to sell platinum (a million units). *SOB*, as she affectionately refers to it, was the recording that introduced the public to the sound of the synthesizer.

Few listeners had any grasp of the painstaking craft that went into *SOB*. Often, a single line of melody required many overdubs of individual notes with an instrument that tended to drift out of tune between takes. Today, Carlos brings the same meticulous care to projects that use far more advanced technology. One of her passions is alternate tuning systems, a field that has only become practical to explore with the advent of digital instruments. Her more recent albums, including *Digital Moonscapes* (1984) and *Beauty in the Beast* (1986) have explored the phantasmagorical world of electronic orchestration.

We spent more than an hour on the phone with Wendy, and she had far more to say about music and computers than we have room for in these pages. (For the full text, dial up www.music-and-computers.com.) What follows are the most provocative portions of the conversation.

Tell us about your new CD.

A couple of years ago, some people I know asked me to do something for people in their twenties, because they felt that there's not very much intelligent music being done for Generation Xers, and could I do something that wasn't classical, wasn't Baroque, wasn't rock, wasn't jazz, but had elements of the kinds of things that the younger audience was listening to, and yet still be myself? And I'm afraid I disappointed them. The idea of making something that was based loosely on *Clockwork Orange* [a Stanley Kubrick film that Carlos scored] had also come around; it just didn't work with

something paced fast with an "up" beat, because *Clockwork Orange* is very slow music. It's a dark, somber affair, and a lot of the [new] album is that way. It's very melodramatic, dark, over-the-top, scary stuff. It fits very well with the title *Tales of Heaven and Hell*.

The project took a long time, mostly because of the way I insisted on doing it. Because of all of the complexities of the way it was put together, it couldn't really have been done prior to having DAWs [digital audio workstations] with built-in sequencing, the very thing that's epitomized by [Mark of the Unicorn] Digital Performer, which is what I use.

Unfortunately, on my old [Macintosh] FX, which is what I started the project on, with the big files that these things were turning into, the newest versions [of Performer] were unstable. I had to go back to an earlier version, which was moderately stable but wouldn't allow more than four minutes

of music before the files would self-detonate. So I had to do the thing in little bitty chunks, and then try and link them together, and every time I tried to link them together, the new file would become unstable, and it would crash everything around it. It became the worst software nightmare I have ever experienced. Plus, it was a fairly complicated hardware thing.

Any news about what label the CD will be released on?

Well, by the time the recording was finished, some of the record companies I had initially talked to had sort of lost interest. They thought the project would never happen. A few other companies had become interested, so I'm kind of in the junction of not knowing who to go with right now. We've just begun talking with a few people.

You said you started the recording on a Mac IIfx. Did you switch to a Power Mac?

That's what I'm using now to finish the project. It's an 8500. I still use the FX interactively. I have always liked having two computers in a studio at one time because

they can do different tasks, and it's handier than even the best multitask single machine.

What two tasks would you be using two computers for at the same time, typically?

Sometimes I might be using [Coda] Finale, because it's still my notation program of choice, even though Performer does a pretty reasonable job of printing out music. I like to sketch out and get printed-out copies of what I'm doing, so that I can figure out where the piece is going. With alternative tunings and that, you get into such difficulties in trying to keep track. [*Ed. Note: See "What Are Alternative Tunings?" below.*]

I don't write simple music, and I cannot just do head arrangements, which is what most so-called electronic composers do. Many of them don't read or write music anyway, so they don't have a need to or don't have any choice in the matter. But notation is a very fine tool [even] if you don't write "eye music," as the Germans used to call it. If you use notation as the tool that it is, it's very handy. Even in multi-tonal alternative tuning music, where the notes don't necessarily correspond in sound with what you see on the paper, it's good to have something so you can put together the structure of the piece.

Also, it's sometimes very stable to run audio on one machine and MIDI on the other, or some parts of the audio on one and some parts on the other. The machines behave better, and you get more audio channels.

For this album, you were using a combination of MIDI sequenced stuff and audio tracks, right?

Exactly. It's what I think everybody's doing. I've now spent a lot of years so that I can really make mostly any sound I wish to make. There are still things I find more expedient to use Kurzweil sampling for, although I've never liked samplers in the past because of their lack of expression. Some of the newer, sample-based synthesizers are now becoming quite expressive, so you're not just getting that "dant-dant-dant-dant-dint-dant-durnt-durnt," you know. Now I have a lot of tools within the V.A.S.T. business [Kurzweil's synthesis architecture] that let me start plastically manipulating sounds and making them respond to what I'm doing with the controllers, the velocities, and all of that. I find that textural sounds which are going to be moved around and pitched differently, and layered rhythmically, those are best run off of things like Kurzweils.

What Are Alternative Tunings?

The conventional 12-note scale found on both the piano and synthesizers is called *equal-tempered*, because the octave is divided into 12 steps of equal size. This compromise tuning was developed to allow music to be played in any key. Many other types of tuning are used in other cultures, and were used in European music in earlier centuries. In many historical tunings, the 12 notes of the scale are not spaced equally. As a result, some chords sound relatively pure, while others sound very odd. Alternative tunings developed more recently sometimes provide more than 12 notes within the octave.

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Wendy Carlos

Do you use a Kurzweil K2000, or a K2500?

I've got two 2000s. I prefer having 32 MIDI channels, because I do a lot of multitimbral stuff, and one 2500 would definitely be not enough. They're both loaded machines, they have a lot of RAM in them, and they have a lot of sounds, which are mostly *musique concrète* things that I've built here myself. [*Ed. Note: See "What Is Musique Concrète?" on page 58.*] I'm getting back to using *concrète*, which is what sampling seems to allow once again, and then a lot of real synthesis. The world of the audio on hard disk is more *concrète*, because you're playing back textural things that are so long that you don't really want to put them in a sampler. What's the point of having something that runs for two minutes be on a note in the sampler?

I'd rather use the memory for great big, long, fat samples of single-event notes and

tempos. Digital Performer allows all kinds of time and tempo-warping, and pitch-warping. They're really powerful tools. If it only weren't so damn slow. . . . But the scalpel is very sharp, and it allows you to cut very precise layers and put together a piece of music that can be very plastic and very alive.

You mentioned being able to pitch-warp and time-stretch in Digital Performer. I'm wondering whether the little glitches and artifacts that can be created by that process bother you, or if you have tricks for getting around them. How do you deal with that?

You try them, and if they don't work, well, even if the idea was good, you don't use it. Sometimes also, I've found that I can take things that have glitches, bring them into [Digidesign] Sound Designer, and find little spots, and do little crossfades, and hide them. It's like having scratches on a photograph that you scan and put into [Adobe] Photoshop: You've removed the flaws artificially, tediously, by hand. It takes forever, but that's the way you do it, if it will work.

I tend to clean my things rather meticulously now. Everyone's talking about 20-bit audio, but I don't think many people have

Carlos's landmark album *Switched-On Bach* became the first classical disc in history to sell a million units.

the like, and then the things that are probably only going to appear once or twice, put those in hard disk audio. Also, of course, you can bounce them back and forth. You can take sections of a long audio file, poke it into the sampler, play with it there, and then sample out what you've now played with it back into a hard disk file, and then that can run in sync with the new things you're adding.

I'm having a great deal of fun reaping the benefits of this hybrid, mature technology. Well, I guess "mature" is . . . it's not stable mature, but it's at least conceptually mature. This is a very, very decent way to make music, having all these kinds of tools linked together so you can do all of the personal, expressive stuff that we can do now with an elaborate MIDI setup, and with responsive synths get that to play back in a way that is every bit as alive and natural as a live ensemble would be, using sounds that go everywhere from the wildest "electronic-y"-sounding things, through things that are actually acoustically replicate-sounding, or *concrète* things that are somewhere in the cracks, or hybrids of three of the above put together, and then layer that in with the live performance parts which are better handled with a multitrack audio metaphor in the DAW. And it's all synchronizable; you can change your mind, you can vary the

really squeezed very much out of 16 yet. It seems to me that 20-bit would be nice for the masters, and for people who record live orchestra and ensembles who are unpredictable in their dynamic range. For those cases, it'd be nice to have extra bits, but as long as the final result is going to be 16 bits, I don't care what they say. This is a case of knowing where the bodies are buried. I try to do the job rather deliberately.

So you're getting the most you can out of 16 bits.

I'm squeezing it in a lot of ways. I don't really want to point to every dead body and where I put some perfume around the corpse so you wouldn't smell it, or how I made a hologram of another corpse so that you have the illusion it's there. It's possible to use the tools like a surgeon to do plastic surgery on your music. I feel like I almost massage every molecule at the end.

Would that involve noise reduction, EQ, compression, or all the above?

All of the above! I don't use automatic compression very much. I'll usually go and tweak regions by hand, because sometimes a limiter will just take off all of the peaks. I'll go and find the ones I don't think would mind coming down a dB or two, then I can enlarge that entire spot so I can give a real "oomph" to an attack. Then

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Wendy Carlos

with several stepped regions selected, I'll do a very small decibel change on each to form a ramp. It becomes a very gentle, little easing in so that I can give the maximum sound output at that moment for some sounds without sacrificing anything else in the neighborhood. So there are no artifacts, nothing that's doing the things that invariably happen when you use any automatic machine. I'm in favor of throwing away most automatic processes, and taking on the tools in my hands raw, and using them very carefully, one at a time.

Is the creative process itself any different because you're using computers than it would be if you were using a pen and paper and then hiring an orchestra to play it? Do computers really create a different creative space, or do they simply allow you to do the same things in a different way?

I don't really know how composition works. You feel like themes and the like

work, so the bridges are bad? Or are the bridges good, but the material sort of dull, so you've got a polished job on mediocre material? Or do you have some great things here, but you ought to pull it apart into shorter pieces because it's not making it as a large structure? Or is it exactly the opposite problem?

Questions like that have never changed in all the years I've been writing music, and from reading biographies and interviews, and talking with other composers, and other people in other creative arts, [there's] no difference. I don't think computers change it at all, it's just for the disturbing [difference] that, because they're more brittle, you're more likely to find that that stream of consciousness will be interrupted, making you sometimes wonder why you don't just take the whole shmear, open the window, and drop it down to the sidewalk below.

Did you ever want to do that to your old modular Moog?

Yes. Oh, God, that was a nightmare, too. In some ways it was a worse nightmare, because you didn't have the wide variety of sounds. It's such a large family now, I don't feel the sting of my old teachers telling me that if you're interested in composing for

"I have always liked having two computers in a studio at one time. It's handier than even the best multitask single machine."

are filtering through your mind. You're aware of being an editor, you're aware of saying, "No, not that. That's not good enough." You're aware of throwing things out that you've spent days, weeks, even months doing, because something better just pops into your head. You're aware of the time you've spent, you're aware of every little bit in the music at the end, that it all went through you, but the process itself is somehow still almost magical. That's just the act of being creative. It's not music composition *per se*.

In the case of the tools of computerdom, the canvas and the colors are different, but the steps of making great music are still the same steps. Form is still the biggest bugaboo in any piece of music longer than a minute or two. Anyone who hasn't attacked anything [larger than] a song doesn't know what I'm talking about. But the minute you try and get into a longer, abstract piece of music, even if it's program or film music, you're facing formal questions: How do the structures relate to one another? Does this lead to the other logically? Do themes come in and never repeat that almost seem like they're gratuitous, and therefore like you threw in too many ideas instead of working them through? Or did you work them through enough, but the things that tie them together don't quite

timbre, stay with the orchestra; if you're interested in composing new, odd things, you can stay with electronics, but it will not give you the range of timbre that you can get with an orchestra. That's no longer true. So, for that reason, no, I'm not unhappy using this medium, and I don't feel necessarily that I would rather use a pencil and paper for an orchestra. But with some of the themes and ideas that come along, it would be nice to have a live orchestra waiting to add its contribution to the electronic elements.

I remember a few years ago, in an interview, you were talking about how you had started with an original Macintosh. Was it a Plus?

No, it was the 128. We got one right at the beginning of the first year they were available, 1984. So we saw the first interface, when in order to copy a floppy, it used some of the screen RAM, and so the screen filled up with black and white dots. And then that machine got added onto. It became the 512, and the 512KE, and then a Plus, and then it was turned into a Prodigy Prime. And then I updated to a IIx, then to a IIfx, and now to the 8500.

In fact, every one of these synths, since the Moog, is a computer also. We're working

Wendy Carlos

with multiprocessor environments. A good MIDI interface box like a [Mark of the Unicorn] MIDI Time Piece, that's a computer. And then Jim Cooper's various little [JL Cooper] devices, those are each computers. Each of those has its own little computer, and sometimes they will go down. Sometimes the little simple passive [MIDI] merging box that you're using for putting together a lot of controllers, that'll go down, and the notes that you're trying to input suddenly are either blocking up, or being polluted in some way. It's hard to find where the problem is, because there are so many places it can happen.

We could talk about malfunctions all day.

Oh yeah! At least you could make it plain, especially for people who think that this is a quick, cheap ticket to success and fame and fortune, which it's none of, honestly. It's almost exactly the opposite, especially at this stage, where it's highly competitive. Too many people have gotten into the field. They should be discouraged, really, because there's nothing to be gained except if you're on a hobbyist level, and you enjoy it for your own pleasure, and you don't mind these problems, that's fine, but the truth is that it's a very onerous, difficult way to make music. At least what I describe as being music.

Sometimes technology is oversold to consumers as, "Now, you can make professional-sounding music, even if you've never had a lesson!"

Oh, dear. There was a magazine, I think it was called *Compute*, which was dealing with, I think, Apple IIe's and the like. Somebody was quoted as saying that there were going to be so many more Beethovens now, thanks to the new technology. It's wanton lies! That is not true. Art comes from creative people doing a job well. Some part of it is a gift, in which case you can take no bows for it; other parts it's just pure sweat work, in which case you *can* take a bow for it. In any event, human beings are not decided on their value in life by whether or not they can put together a good string of notes. Some of us do it well, some of us don't. And you can still enjoy the act of music and do it for your own recreation, without being in any way a great composer. Why should you take on that onus, anyway? And why *shouldn't* there be people who can do it a little better than others?

What you *should* say is that the technology allows even people who've never

trained in music to learn to do music on their own, and by their time, and sweat, and natural talents, they will achieve or not achieve varying degrees of success.

And technology certainly makes it easier for people like Brian Eno, who perhaps had no conventional music training, to achieve some wonderful things that would not have been available to us otherwise.

The only thing is, don't be surprised that some of his material sounds like it's lacking performance value, because he doesn't know how to put in that aspect unless he hires performers. A great deal of electro-acoustic music seems to come from a mindset that champions getting rid of the performer, whereas in truth, the technology is slowly coming around to giving us the control that a great performer needs to put the notes and the sounds and the events together in a fluid, graceful, elegant manner, and that is not what a composer does. The composer says what to do, but not how to get from point to point to point.

That creates more of a burden on the electronic artist, because it's not enough to be a great composer; you also have to become a great performer.

What is *Musique Concrète*?

With the advent of magnetic tape in the late 1940s, it became practical for composers to use natural acoustic sounds as an element in their scores. This technique was pioneered in Paris by Pierre Schaeffer and Pierre Henry, hence the use of the French term *musique concrète* (literally, "concrete music"). Early *musique concrète* pieces were created by cutting and splicing dozens or hundreds of short pieces of tape. Today, the same results can be achieved far more easily in a computer.

Not in real time, but you now have to wear those two hats.

And you should, if you're going to do an electro-acoustic thing, become a great orchestrator and instrument-builder as well, too. Otherwise you'll have to just write to the companies and buy their pre-packaged sounds — which is fine, except then you're using canned art, in the same way that people who design brochures and little business publishing notes might use clip art, because they don't know how to draw.

Can you remember the first time you encountered alternative tunings?

I was playing with my parents' piano back when I was an adolescent. First I thought, "Well, I'll go to the music store and get a tuning thing, because I bet I could tune a piano," and then I discovered, "Oh, my God! This is hard!" And I went and got the books from the library, and really then

was worried, because it's even harder than you think it is. I started playing around with just, and with meantone, and with some extended oddball scales. It was slow and tedious to do on a piano. For three or four days I'd leave it in one tuning, then the next week I'd try some other tuning.

What scales did you use on the new album?

For music that forms a moderately conventional-sounding Western harmonic progression, I still prefer using some version of meantone, or the Werkmeister scales. Also, I had never done a piece in 15-note [equal-tempered] tuning, and I thought I would try that.

There are also some random tunings that I've invented just to try and find, by ear, intervals the way the Indonesian musicians might find them, where that pitch for that timbre is kind of in a little niche that's the most provocative next step I could have.

Since a lot of the readers of Music & Computers may never have even considered alternate tunings, how would you explain their attraction or benefit?

It's a little bit like you've only eaten at a fast food restaurant all of your life, and you're suddenly being told that the whole world of *haute cuisine* exists, and that [in] many countries — Northern Italy, France, certainly, and Asian countries — there are these whole values of food that you've never sampled. They're different, and they're much more subtle than what you've had to do to your tongue and taste buds in having to live on a diet of fast food, where the subtleties are all removed by the temperature of cooking.

Like your first piece of sushi, it's strange. But at the same time, these things are based on very real acoustic values, and they're better than anything you've experienced in the past, so given time, if you listen closely enough, you will become aware that something subtle is occurring that you never have experienced before. Some of it can be extremely hard to hear. Others will be smoother and nicer-sounding, and you'll say, "Oh, yeah, I can hear it right away."

But because of the tunings, the musician or composer will have stopped doing certain types of modulations and the like, so it'll almost have a new style of music that you'll hear, which came about because of the tuning, in the same way that Western music tends to be pretty busy about moving from note, to note, to note, all the time. None of the notes really sound that great, so we've evolved a kind of music that's based on trying to hide the

Wendy Carlos's Web site contains detailed information on her unusual instruments, such as this Circon, which she invented to play exotic melodies on The Shining. The pointer arm shows which note you're playing, with the exact center marked by a gray dot, so microtonal passages become possible. A spring-loaded lever on the side can control volume and brightness.

inadequacies of our scale. So you'll be able to investigate kinds of music which don't need to do that sort of stuff. That's fascinating, too.

Is there any software that you use currently for setting up tunings?

The [Opcode] Galaxy editors have a pretty good one for the [Yamaha] TX802/DX7II machines. That's probably the best computer tuning software I've seen. I've used spreadsheets. I find spreadsheets very handy, because you can put in ratios and have them propagate all the way down, so that you can find the numbers in Yamaha tuning units and in cents [hundredths of a semitone]. You can make all those things happen on a spreadsheet, but in the end you still have to sit down with the synthesizer and type it all in, and that's extremely tedious. Galaxy's editor will help you as long as you're using instruments that are based on the Yamaha or similar modules.

Do you have any upcoming projects, or anything that has been of passionate interest to you lately that you wanted to mention?

I'm going to do a *Tales of Heaven and Hell Part II*. I don't know what I'll call it, but I want to tap the vein of this extremely dramatic, picture-painting-style music — tone poems. I have a lot of ideas that I've already started on, but we're going to try to get the first one out as soon as we can, and then I will get the next one out, probably much more rapidly now that the new machine seems to be working.

I don't know where I'm going to go from there, but I think there'll always be an interest in alternative tunings in my music for the rest of my career, now that it's become so easy to do. I still will do some music in equal temperament, and some in variations of it, like meantone, but there will also be music. . . . You know, it's like, "What way do you want to eat tonight? Do you want Turkish food, do you want Japanese, do you want Thai, do you want French, do you want Ethiopian . . .?" There are so many ways to go, and we have the stuff to do it now. It would take a rather cowardly, un-curious person not to want to fool with it. ◢◣

to get good results, the right tools are needed. Steinberg's WaveLab is one tool well worth considering.

WaveLab provides all of the features desktop musicians need to burn CDs in their home and project studios — along with excellent performance, quality, and ease of use. For dedicated multimedia audio producers, though, Sonic Foundry's Sound Forge is probably a better package, because it supports a multitude of audio formats, MIDI sampler integration, built-in video, and MIDI and SMPTE synchronization — features not found in WaveLab. (To burn CDs with Sound Forge, however, you need to add a $395 plug-in called CD Architect.)

...sounding all of the major functions of the program, including familiar transport and control bars. Hit your F1 key and you'll get succinct but friendly context-sensitive help on any part of the program.

When you load a .WAV file, it's displayed in its own window with two panes. (See Figure 1.) The top pane shows an overview of the entire audio file and is used for navigation. The bottom pane displays a closeup of part of the file and is where all editing takes place. Right-clicking opens a pop-up menu that allows you to customize many aspects of the waveform window. These changes can then be saved as one of six separate window styles and later recalled instantly.

Cut, Copy, Paste. WaveLab provides all of the basic editing commands, as well as a few special Paste commands including Append, Prepend, Paste Multiple Copies, and Mix. (Append adds the pasted audio to the end of the file; Prepend adds it to the beginning.) Most of the time, however, you won't need to use these commands, due to Wave-Lab's extensive "drag and drop" support.

For instance, creating an audio sample that will later be used as a loop is very easy. First, open the audio file from which you want to grab the snippet. Click on the Options menu and make sure that both Snap To Zero-Crossing and Magnetize Bounds are activated. Now position the cursor at the point within the waveform where you want the beginning of your sample loop to be, and press the Insert key on your computer keyboard to place a marker there. (Markers can even be inserted during playback.) Drag the marker slightly to the left or right and it will jump to the nearest zero crossing. (A zero crossing is the point at which the waveform crosses the zero-volt axis, meaning its amplitude is zero. Cutting or pasting audio regions bounded by zero crossings helps prevent an audible click from occurring on playback.)

Repeat the same steps for the end of the sample loop, so that you now have markers designating both loop points. Double-click anywhere between the two markers to select the area, then click and drag the selection to an empty area on the WaveLab workspace. Abracadabra! A new editing window is created sporting your sample loop, which can now be saved or manipulated. I loved using this technique to create drum loops.

Unlike Sound Forge, WaveLab can't transfer audio files to MIDI samplers, so I saved my drum loops as .WAV files and then imported them into Cakewalk Pro

Fig. 1. Yes, you are seeing double: WaveLab displays audio files in two views at once. The upper waveform view shows the entire file, which lets you quickly navigate to the part you want to edit. The lower window is where the action takes place. Here, a few drum hits are selected, and loop-point markers (the yellow triangles) have been inserted.

Steinberg WaveLab 1.6

24-Bit Digital Audio Editing Software (PC)

By Scott R. Garrigus

With the cost of CD recorders plummeting, it's now possible for anyone with a few hundred dollars to master an audio recording and bring their music to market. Of course, to get good results, the right tools are needed. Steinberg's WaveLab is one tool well worth considering.

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User-Friendly. Since WaveLab was born as a native Windows 95/NT application, you'll be right at home with its look and feel. There are toolbars representing all of the major functions of the program, including familiar transport and control bars. Hit your F1 key and you'll get succinct but friendly context-sensitive help on any part of the program.

When you load a .WAV file, it's displayed in its own window with two panes. (See Figure 1.) The top pane shows an overview of the entire audio file and is used for navigation. The bottom pane displays a closeup of part of the file and is where all editing takes place. Right-clicking opens a pop-up menu that allows you to customize many aspects of the waveform window. These changes can then be saved as one of six separate window styles and later recalled instantly.

Cut, Copy, Paste. WaveLab provides all of the basic editing commands, as well as a few special Paste commands including Append, Prepend, Paste Multiple Copies, and Mix. (Append adds the pasted audio to the end of the file; Prepend adds it to the beginning.) Most of the time, however, you won't need to use these commands, due to WaveLab's extensive "drag and drop" support.

For instance, creating an audio sample that will later be used as a loop is very easy. First, open the audio file from which you want to grab the snippet. Click on the Options menu and make sure that both Snap To Zero-Crossing and Magnetize Bounds are activated. Now position the cursor at the point within the waveform where you want the beginning of your sample loop to be, and press the Insert key on your computer keyboard to place a marker there. (Markers can even be inserted during playback.) Drag the marker slightly to the left or right and it will jump to the nearest zero crossing. (A zero crossing is the point at which the waveform crosses the zero-volt axis, meaning its amplitude is zero. Cutting or pasting audio regions bounded by zero crossings helps prevent an audible click from occurring on playback.)

Repeat the same steps for the end of the sample loop, so that you now have markers designating both loop points. Double-click anywhere between the two markers to select the area, then click and drag the selection to an empty area on the WaveLab workspace. Abracadabra! A new editing window is created sporting your sample loop, which can now be saved or manipulated. I loved using this technique to create drum loops.

Unlike Sound Forge, WaveLab can't transfer audio files to MIDI samplers, so I saved my drum loops as .WAV files and then imported them into Cakewalk Pro
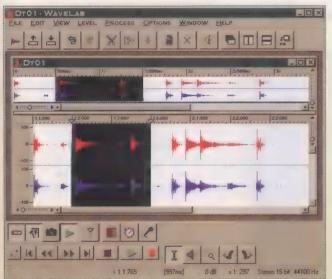

Fig. 1. *Yes, you are seeing double: WaveLab displays audio files in two views at once. The upper waveform view shows the entire file, which lets you quickly navigate to the part you want to edit. The lower window is where the action takes place. Here, a few drum hits are selected, and loop-point markers (the yellow triangles) have been inserted.*

Audio (a digital audio sequencer), where I strung copies end to end like popcorn on a Christmas tree.

If you ever make a mistake, don't worry. WaveLab's unlimited undo/redo function comes to the rescue. Each waveform window

has its own editing history, although you can't display that history or jump back and undo from specific points within it. A workaround: When you get a file to a point where you think it might be right, just select the entire file and drag it to a new window. Minimize that new window and continue to work on the original file. You can do this any number of times (limited only by disk space).

Red Light. Before you record a new file, you have to set up your signal source. WaveLab provides a basic onscreen mixer with on/off switches and volume faders for each of the available audio sources on your computer. With a Sound Blaster or equivalent soundcard, the mixer might display Synth (meaning the soundcard's built-in MIDI synthesizer), CD, Line, and Mic. You can record from any or all of these sources at the same time. Multiple sources are mixed into the same sound file, though.

Files can be recorded as mono, stereo, and dual mono. (The dual mono mode is a special WaveLab feature that allows you to open two mono files as a pair and edit them as if they were one stereo recording. This feature was included because some multitrack audio systems, such as Digidesign's Session 8 PC, treat stereo as two separate mono files.) Sampling rates from 2kHz to 48kHz are available, depending on your soundcard.

Another example of WaveLab's high-end support is its ability to handle 20- and 24-bit files in addition to the usual 8- and 16-bit. Even if your soundcard can only play and record 16-bit audio, WaveLab can still process your files internally at 24-bit resolution. This gives it an edge in quality over most other audio editors. Sound Forge, for example, can only load and save 16-bit (or smaller) audio files. WaveLab files can be saved in AIFF, .AU (NeXT/Sun), PCM (raw), and .WAV (both stereo and dual mono) formats.

Fig. 2. *WaveLab's unique database feature lets you organize audio files by name, keywords, comment, file type, channels, bit resolution, sample rate, creation date, and size. It can automatically input all attributes except keyword and comment by scanning your hard drive or a CD-ROM.*

Audio Access. You can organize your saved files using WaveLab's unique database feature. Let's say you've recorded a number of different drum sample loops and you want to be able to find them easily for future projects. Click on the File menu and select New|Database. Type in "sample loops" for the name and then save it to disk. A new database window opens in the WaveLab workspace with Location, Category, and File List panes. (See Figure 2.) To add your audio files to the database, right-click in the Location pane and select Scan Disk. Now select the drive and folder in which your files reside and click OK. WaveLab will scan that folder (and any subfolders — even on CD-ROM) for audio files and automatically add their attributes to the database. (The database doesn't store the actual files, just information about them.)

The next step is to categorize your files. For example, you might enter "Drums," with a sub-category of "Jazz." You can create as many of these subcategories as you'd like. Now just click and drag entries from the File List pane to the appropriate categories. You can add keywords and comments for even further categorization, but these have to be input for each individual file, which can be time-consuming.

The next time you need a certain type of sample loop, you can easily find it with the Global Search function. Search criteria include name, keywords, comment, file type, channels, bit resolution, and sample rate. You can also specify the file's creation date and size. All of these criteria can be combined and then saved as a Search Preset for future use.

Nearly Real Time. Processing files in WaveLab is almost the same as in any other audio program — select a region of audio and choose a processing function. The usual options are available, such as normalize, change gain, eliminate DC offset, dynamics (as in compressor/expander/limiter/noise gate), EQ, time-stretch, chorus, etc. What makes the program truly special is that all of these processes can be done

while the file is playing.

For instance, open an audio file. Click on the Loop and Play buttons to start the audio looping, then click on the Process menu and select an EQ preset. As soon as Wave-Lab is finished processing the file, you'll hear the difference in the looping audio. Don't like that change? Just click the Undo button to instantly go back to the original.

Now what if you want to add a bit of chorus but are still debating about the EQ? Just click the Process menu and select Hi-Fi Chorus. The Chorus dialog box opens, but the EQ dialog remains open too. This is called a *non-modal* dialog — you can keep any processing dialog open and on the screen while working with a file so that you don't have to keep opening and closing. And it can all be done while the file continues to play. You can even *save* files on the fly.

Really Real Time. In addition, WaveLab provides realtime processing functions through its Master Section plug-in architecture. The Master Section is the final stage through which all audio files are played. Based on an effects-rack metaphor, the Master Section allows you to chain together up to six plug-in effects in sequential order. For instance, to add a bit of chorus, echo, and reverb to your

sound file (in that order), just click on the first empty "rack" slot to reveal a drop-down menu listing all of the plug-in effects currently installed. WaveLab comes with a good number of its own plug-ins. It also supports the Microsoft DirectX plug-in format.

All of WaveLab's proprietary plug-ins sport the effects-rack look, which will make anyone who has used outboard effects gear feel right at home. These on-screen versions work just like the "real thing" with parameter dials and all. (See Figure 3 on page 66.) The only drawback is that changing the parameters can sometimes be tedious, because you can't alter values by typing them in. Luckily, Presets can be created to save your most frequently used settings.

After your chorus parameters are set, select the echo effect for the next plug-in slot and finally the reverb effect for the third plug-in slot. From here you can process the sound file in two ways — either by using the Master Section Apply function (which changes the actual file), or just by pressing the Play button and listening to the effects in real time without physically altering the file.

I'd say that all of the effects except the reverb are project-studio worthy. Instead of

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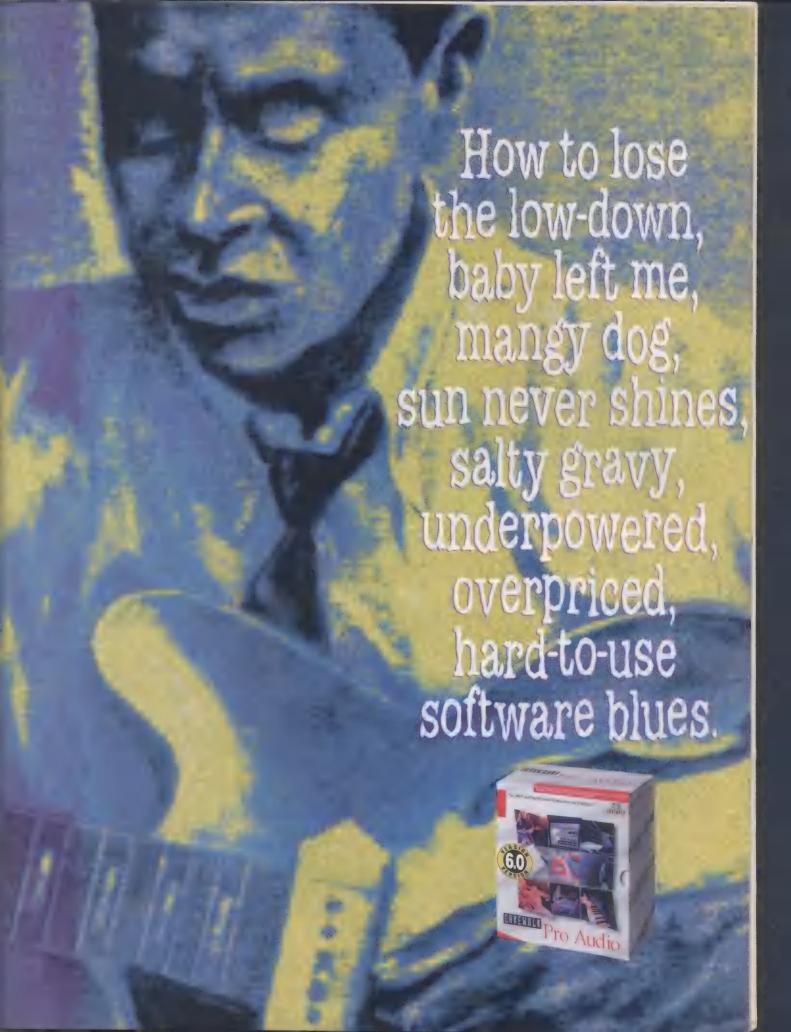
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Continued from page 63

providing smooth decays like a good outboard unit, WaveLab's reverb has a bit of an edge reminiscent of cheaper rack-mount boxes.

The power of your computer system determines how many plug-in effects you can have running at the same time. Steinberg recommends a Pentium 166 or better with 32MB RAM. My experiments, however, revealed some surprising results. Even using a lowly Pentium 75 with 24MB of RAM, I could use up to five of the supplied plug-ins at once.

Of course, the realtime feature is best used as a preview facility, since you'll have to commit the effects to the file when it comes time to save to disk. (You can also use it as a realtime effects processor for external signals — like a hardware effects box.)

Unfortunately, the Master Section doesn't allow you to save the combination of effects in the "rack" as a preset. You'll have to keep a written record of your favorites. Having multiple plug-in effects open at once can become cumbersome as well. There's no global bypass button, so if you want to hear your file unprocessed, you have to mute each effect individually.

An undocumented kludge for this oversight is to add your file(s) to a CD Program (see below). Files played via a CD Program can bypass the Master Section if desired.

Burn, Baby, Burn. When your files are all recorded, processed, and saved, it's time to master your audio CD. Just click on the File menu and select New|CD Program.

This opens a blank CD Program window, which will hold the track list information for your CD. To add a file to the list, click on the CD Wizard menu and select Add Track(s). You can add multiple files at once. After your files have been added, the list will display each file as a separate CD track, showing the track title, start time, length, copy protection status, emphasis status, ISRC (International Standard Recording Code), and comments. (See Figure 4 on page 68.)

If the tracks don't appear in the order you'd like, just click and drag them. You can also change the track title and comments, but these are only for your reference; they aren't written to the CD. To change the pause length between tracks, click on the plus-box next to the track you want to alter.

Once all your tracks are set, double-click on the first track and the CD Program will play through the entire list just as if you were listening to your finished CD. If everything sounds cool, click on the CD Wizard menu and select Check. This function checks to make sure that your track list conforms to the Red Book standard. (For instance, every track must be at least four seconds long.)

Fig. 3. *The virtual effects processors supplied with WaveLab are designed to work like their hardware counterparts. Unfortunately, this means that you can't change the parameters by typing them in.*

Now click on the CD Wizard menu and select Write CD. Choose a writing speed (from 1X to 6X), select the "Test writing of the whole CD," and click OK. If all is well, the test will run through without a hitch and you'll be ready to commit your files using the write operation.

If the test fails, it could be due to a number of reasons, from hardware incompatibility to software driver problems. In many cases, you may just need to update your SCSI adapter-card drivers, but it may also be a problem of writing speed. Writing CDs at speeds higher than 1X can sometimes be tricky, so if you run into this problem (as I did), try changing the Writing Speed to 1X.

You may also need to change both the "Number of buffers" and "Number of CD frames per buffer" to 1 in the preferences dialog box. The cause of the problem still eludes me, but this little solution allowed me to burn my own CD. See www.steinberg.net for the latest driver software and a list of compatible CD-R recorders.

File|Exit. Idiosyncrasies aside, Wave-Lab is an excellent tool for any musician looking to master his or her own material to CD. WaveLab's realtime architecture

Fig. 4. Out of the lab and into the world: WaveLab's integrated CD mastering function makes burning your own CD easy. The "+" boxes let you set the blank time between tracks; the key column denotes copy-protected status; the rainbow column denotes pre-emphasis (a noise-reduction technique), and the ISRC column lets you enter an optional code containing the year of release, serial number, and other information.

makes the mastering process not only more efficient, but fun, too. Unlike editors like Sound Forge that only provide CD-burning capability through the purchase of an additional software plug-in, Wave-Lab provides all of the necessary tools to record, edit, and process audio files in preparation for CD mastering — as well

as the mastering software itself — in one nice, neat, integrated package.
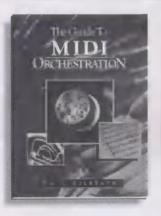
Scott R. Garrigus likes to play with audio every chance he gets. He especially loves preparing files to exhibit on his Web site. Take a listen at www.pan.com/garrigus/.

DESKTOP RECORDING POWER TIPS

S ome of the most popular articles in M&C have arisen from conversations the staff has had with musicians who are fired up about some new idea or technique. So one recent afternoon, we decided to push the river a bit and called up some of our favorite contributors. We innocently asked what they were excited about, then once they were babbling happily, sneakily suggested they write up a batch of tips on it.

Mark Nelson, who has recorded several albums at home on his computer, was the first to hit the e-mail button, sending in these unusual tips for recording and processing digital audio and MIDI. Some tips assume you have a MIDI/digital audio sequencer or other program that will allow you to edit both types of data side by side. —Editor

Put Away Your Noise. If disk-drive or computer fan noise is ruining your recordings, the best (although somewhat pricey) solution is to buy a cable extender. These devices let you place your computer and drives in one room, and your monitor, keyboard, and mouse in another. (Note that many microphones can still pick up the high-frequency whine from a computer screen, so it's wise to use a unidirectional mic and point it away from the monitor.) Some companies that make extenders are:

Cybex, 4912 Research Dr., Huntsville, AL 35805; 205-430-4000; fax: 205-430-4030; Web: www.cybex.com.

Gefen Systems, 6261 Variel Ave., Ste. C, Woodland Hills, CA 91367; 800-545-6900 or 818-884-6900; fax: 818-884-3108; Web: www.gefen.com.

NTI, 1275 Danner Dr., Aurora, OH, 44202; 800-742-8324 or 216-562-7070; fax: 216-562-1999; Web: www.networktechinc.com.

Put Away Your Noise II. Another way to get quiet is to buy or build an isolation box for the CPU and drives. Ventilation is critical; computers can build up an amazing amount of heat, then they die, so make sure air can circulate freely in and out of the box. Unfortunately, this may require installing fans, adding back some of the noise you just removed.

My solution? I placed my CPU and hard drives on a low shelf. Strategically attaching foam to the underside of the shelf above the CPU and to the wall immediately behind it dulled the fan noise to an acceptable din. I also built a small gobo (portable sound wall) to fit directly in front of the desk.

Goo Are So Beautiful. You can mask a lot of noise from CPU fans, single-coil pickups, cicadas, snoring German shepherds, etc., by adding a track with a subtle wash of synthesizer goo. New age music explained at last!

Processing & Ambience

Phony Stereo 101. The quick and dirty way of tricking out a mono part is to apply some kind of stereo processing, such as chorus, delay, or reverb. But here's a more unusual suggestion: Copy the mono track to a new track and run both tracks through compressors, applying slightly different compression ratios and thresholds to each side; pan the channels slightly apart from each other.

Phony Stereo 102. Instead of compression, use "mirror image" EQ on each side — if you boost the left side 3dB at 100Hz, 500Hz, and 2.5kHz, cut the right side an equal amount in the same places. This is the classic "electronically processed to simulate stereo" effect from old LPs.

You Look Offset. Moving the copied audio track forward or back in time by a few milliseconds creates different types of effects, such as:

Thickening. Offset a

By Mark Nelson

copy backwards by 5–10 milliseconds, pan it slightly away from the original track, and mix it in at lower level.

Doubling. Use a slightly longer offset, say 10–20 milliseconds. Experiment with pan, compression, and EQ settings to differentiate the copy from the original track. This is a great way to fatten up vocals.

Flanging. The usual way to create this effect is by modulating the delayed signal with an LFO (low-frequency oscillator). But you can make some cool sounds of your own: Break up the copy track into smaller sections and move them forward and backward by different amounts. Even better, do it to multiple copies. Used subtly, it brings a track to life, but who wants to be subtle?

Chorusing. Offset in the 40–100 millisecond range. (Use your ears; the best offset will depend on the original sound.) For a huge chorus effect, I mix together multiple copies offset to different values panned widely across the stereo field. Applying different EQ to each copy heightens the realism — or mayhem.

EZ Rhythmic Delays. Copy just the notes to be emphasized to another track and quantize them to the desired note value. Draw in volume and pan changes as needed. For some real fun, try using "swing" or "groove" quantize.

The World's Most Tedious Compressor. If you've normalized an audio file but find it still has a low average level (and if you have more time than outboard gear), try this trick: Go through the file and selectively lower the level only on the transients (high-energy spikes that stick out from the rest of the waveform). Then bring up the entire file to the desired level. This sounds more natural than

any compressor made, but takes forever. Of course, do this once and you'll spring for a software compressor.

Tuned Reverb. This is one of my favorite effects. Double an acoustic part with an airy synth pad (a sustaining sound with a long release time). Offset the synth part back in time a bit. Pan it slightly away from the acoustic part and mix it in very low. This adds a wonderful nuance richer than any 'verb.

Only One Effects Box? Record a separate track of 100% wet effects for each track and combine them when you mix. As a bonus, you may be able to automate the whole mess through your software, fading the effects in and out.

Conversely, don't record with reverb if you are going to bounce tracks (for example, mixing multiple parts of an overdubbed harmony down to one track). Multiple reverbs quickly multiply to mush.

Give Me Room. Record some room ambience and play it simultaneously with your sequenced MIDI tracks for a more natural sound. It's a good way to bring "real" and sequenced parts into the same sonic space.
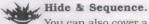
Give Me More Room. When I need to move one or more notes of an otherwise acceptable audio track, I'll crossfade in a little room noise to cover any gaps. This goes double for voice-overs and spoken-word edits for video soundtracks: Nothing sounds worse than dead silence between phrases.

Guitar Tricks

Clam Fix #1. Sometimes you can't help recording a flubbed note on guitar or other plectrum

instrument. If it's a matter of the right note that got partially muted by the pick or a finger, no prob: In your waveform editor, simply lower the level on the attack portion of the note and then raise the remainder of the note. It's best to do it in several small increments. (See Figures 1 and 2 on page 72.) If there's not enough tone to work with, try crossfading in a similar note from elsewhere in the file. If you don't have a waveform editor, draw a volume curve to hide the attack portion of the note and bring up the rest.

Hide & Sequence. You can also cover a botched note with the same note from a synth, mixed very low. It won't pass the "golden ears" test, but it may get your commercial out the door on time.

Eek! Finger Squeaks! You can lessen their impact by tweaking the offending portion of the waveform. Drop the gain 6–12dB while cutting the high mids (around 2.5kHz — experiment). Be sure to apply identical cuts to both sides of a stereo file, otherwise the squeak will suddenly jump across the speakers. Ironically, if you eliminate the squeaks altogether, the recording often sounds wrong.

Bionic Harmonics. Another of my all-time favorite tricks: Make your guitar harmonics jump out of the mix by doubling them with wind chimes or a little bitty triangle. A synth vibes patch will do, too. Mix in the bell part almost subliminally.

Six-String Antenna. When recording an electric guitar with single-coil pickups, stay well away from your computer screen

DESKTOP RECORDING POWER TIPS

unless you're fond of noise. You may have to rotate the guitar until you find a quiet spot.

Nashville in the String. This isn't really a digital audio workstation tip, but it's so cool I have to share it: the secret to the huge Nashville guitar sound. String up a spare flattop as follows: .010, .014, .008, .012, .018, .027; tune the *E* and *B* strings as usual, with everything else one octave higher than normal. This is the famous "high string" guitar; use it to double your acoustic guitar parts, panning them left and right.

Percussion Tricks

Real Them In. To make sequenced percussion parts come alive, record at least one track of "real" percussion — such as tambourine or triangle. Can't keep time? Record just a few bars at a time and use "strip silence" or a similar command to create discrete events that can be quantized or manually aligned with the beat.

The Elvis Presley Memorial Snare. Brushes on a cardboard box and a touch of slapback echo. Fifty million records can't be wrong.

Other Wacky Percussion Ideas I've Used. The spritz from an aerosol spray can became a closed hi-hat; slapping my car keys in my pocket produced a half-closed hat; a wok lid suspended and struck lightly with a salad fork made a dandy gong. Thumping large cardboard boxes . . . paint brushes on a paint roller tray . . . fingers drumming on cassette boxes . . . scissors . . . German shepherds (sleeping) . . . most everything in the kitchen. Transposing mundane sounds up or down by extreme amounts can produce wonderful effects.

A Little Slop Is a Beautiful Thing. I usually match sequenced parts to the tempo and feel of acoustic parts, rather than the other way around. I might start with a very basic sequenced rhythm loop, then add acoustic parts and vocals. Only when I'm satisfied with the acoustic groove do I flesh out the sequenced parts. ◀〵〵

Fig. 1. Fixing a clam, pre-op. The cursor shows the click from a badly fingered mandolin note (the third in a series of four). Since this is a stereo file, any edits should be made symmetrically on both the left and right channels. This maintains the stereo image.

Fig. 2. Post-operation and a happy patient. I eliminated the click, raised the remainder of the note, and brought down a bit of the second note very slightly to lessen the contrast. All four now have pretty much the same shape — you'll have to trust me that they sound better, too.

Multi-instrumentalist Mark Nelson lives in Southern Oregon's Applegate Valley. Although known to frequent real recording studios to twist knobs for pay, he recorded his most recent CDs in his garage. You can hear audio clips at www.scoutserv.com/ indie/wizmak/.

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Setting Up a MIDI System (Part 2)

Over the years, my MIDI system has grown and spread like a patch of bamboo. Synthesizers, effects processors, and MIDI accessories have come and gone, to say nothing of the computers (first an Atari ST, then a Mac SE/30, then a 486 PC, now a 166MHz Pentium that's already starting to show its age). Keeping all of the signals flowing where they're supposed to, with no data glitches, can be a challenge.

Of course, this is a nice sort of problem to have. But it's only a nice problem if you have the right equipment and know-how to deal with whatever comes up. In this series of columns on MIDI/computer systems, we're taking a close look at the former while imparting as much of the latter as space allows. In the Sept/Oct issue, we were discussing the various components that can be included in a MIDI/computer system, starting with synthesizers, master keyboards, and effects processors. We had just gotten to the most important component of all — the computer-to-MIDI interface — when that dang art director told me to put a sock in it because I had gotten to the bottom of the page. So let's pick up where we left off.

Interfacing. Nothing is going to happen in a MIDI/computer system, musically speaking, until the MIDI messages are flowing in and out of the computer. If you happen to 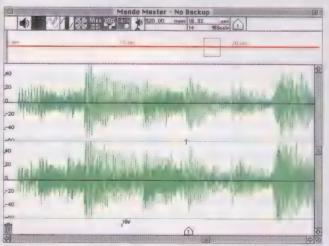be using an old Atari ST computer, you can skip this whole column: The ST and its brethren were manufactured with built-in MIDI In and Out jacks. PC and Macintosh owners, however, need some type of MIDI interface.

On the PC side, many soundcards are capable of functioning as MIDI interfaces. Typically, an adapter with MIDI jacks (see Figure 1) can be attached to the soundcard's multi-pin joystick port. This adapter may *not* be supplied with your soundcard. If it isn't, check at the store where you bought the soundcard, or contact the manufacturer directly. It's just a piece of plastic with a couple of resistors and ICs inside, so it should be in the $20 range.

In addition to the hardware adapter, you'll also need a software *driver*. The driver

is a Windows widget (a DLL, to be technical) that allows your music software to send and receive data via the MIDI interface. Most likely, this driver was automatically installed when you installed the soundcard software.

If you're going the soundcard route, it's worth noting that some hardware MIDI adapters sold for use with soundcards end in MIDI *plugs* rather than MIDI *jacks*. This is a bad idea; insist on the kind with jacks. You'll have to purchase your own MIDI cables, but later on, when you buy a tower PC and want to put it on the floor, all you'll need will be longer cables, not a new adapter.

PC users who don't have soundcards have several other options in MIDI interfaces. A typical PC interface consists of an ISA card, some sort of breakout box with the MIDI jacks, and a special connector cable that links the two. However, some interfaces take advantage of the PC's serial (COM) or parallel (printer) port, eliminating the need for a vacant card slot. In any event, the interface will come with

driver software, probably on a floppy, which you'll need to install in Windows.

Be sure to check the Web site of the interface manufacturer; you may be able to download a version of the driver that's newer than the version in the box. It's not unheard-of for a new piece of MIDI software to fail to work with an older driver, so it's worthwhile to make sure you have the latest driver installed. I've also seen software that would work fine with an older driver but not with a newer one. If you run into this problem, the tech support staff of the software company should be able to help you sort it out.

The Rest of the World. On the Mac side, the MIDI interface will be an external box of some sort; it will hook to either the modem port or the printer port (or, optionally, to both) using a standard Mac serial cable. You won't need driver software, exactly. You'll need one of three System extensions: Apple MIDI Manager, OMS, or FreeMIDI. The manufacturer of the music software you're planning to use

Fig. 1. *This MIDI adapter cable attaches to the joystick port on a computer soundcard, allowing the computer to communicate with external MIDI devices. The cable provides one MIDI input, one MIDI output, and a duplicate joystick socket. Unfortunately, the manufacturer — one of the largest soundcard companies, incidentally — configured the MIDI connectors as plugs (male connectors) instead of jacks (female ones). This means you'll have to buy a female-to-female MIDI adapter if you want to move your synth more than three feet from the computer.*

should alert you to which extension(s) their program is compatible with. In many cases they will supply the appropriate extension, which will be automatically installed when you install the software. You can download MIDI Manager from www.music-and-computers.com. (It's no longer supported by Apple.) FreeMIDI and OMS are available from www.motu.com and www.opcode.com respectively.

Here's another wrinkle in the MIDI interface game: Yamaha, Roland, Korg, Alesis, and Kawai (among others, I'm sure) build small desktop-type synthesizer modules that also function as MIDI interfaces for the computer, eliminating the need to have a separate interface. You can connect them to the computer and hear Standard MIDI Files that you've downloaded from the Web, or plug a MIDI keyboard into the module's MIDI In jack in order to record your keyboard performances into a sequencer. These modules often swing both ways: You can use one with either a Mac or a PC. If you buy one of them to use with a PC and you don't have Web access, make sure the driver software is packed in the box. If it's not, the music retailer from whom you bought the module should be able to supply it.

Hooking Up. The adapter in Figure 1 on page 73 has one MIDI In and one MIDI Out. Some computer/MIDI interfaces have eight of each — or more. But we'll have to defer our discussion of such *multiport* interfaces until next time. For now, let's talk about how to hook up a simple MIDI system, in which the computer has only one In and one Out.

As long as you have a single synthesizer, the hookup you'll need is pretty straightforward: MIDI Out to MIDI In, and MIDI In to MIDI Out. But what happens when you add a second instrument?

Take a look at Figure 2. You'll see that one of the instruments acts as the *master keyboard controller.* The other, even if it has a keyboard, functions strictly as a tone module: You play its sounds from the master keyboard. If you have two instruments with keyboards and want to use both keyboards for recording into a sequencer, you'll need some fancier hardware, such as a two-input interface. (You can always play them both directly if you're not concerned about recording.)

After connecting the cables as shown, you'll need to think about MIDI channel assignments. When MIDI was first devised in the early '80s, 16 channels seemed like a lot. Who except Rick Wakeman would ever own more than 16 synthesizers? But in those days, *multitimbral* synths hadn't been invented. Today it's not at all unusual to find a multitimbral MIDI instrument that's able to respond on all 16 channels at once. When you add a second multitimbral instrument to this simple system, it's going to have to share channels somehow with the first instrument.
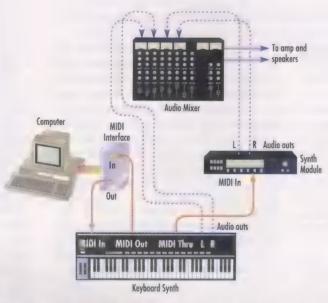

Fig. 2. *A simple MIDI/computer system with a single-port MIDI interface and two instruments. The first instrument functions both as the master keyboard and as a MIDI tone module, as explained in last issue's column (Sept/Oct '97). The second instrument receives the same MIDI data from the computer as the first instrument, because its MIDI In is hooked to the MIDI Thru of the first. (A MIDI Thru jack transmits exactly what is received at the MIDI In jack.) Since we have more than one instrument, we need an audio mixer to combine the four channels of audio into a single stereo signal that can be sent to the amplifier (or to a tape or hard-disk recorder).*

Fortunately, multitimbral instruments almost always allow you to switch each channel off if you don't want the instrument to respond to incoming MIDI messages on that channel. With two instruments, it's a simple matter to set up the first one to respond on channels 1 through 8 and the other on channels 9 through 16. Additional instruments, as you acquire them, can be *daisy-chained* together by connecting a MIDI cable from the MIDI Thru jack of the first instrument to the MIDI In of the second, from the Thru of the second to the In of the third, and so on. Each instrument can be set up to respond on as many or as few MIDI channels as you might need.

If one MIDI instrument can play parts on all 16 channels, you might wonder why you'd ever need a second instrument. There are at least four reasons:

▪ All MIDI instruments have limited *polyphony,* which means they can only play a fixed number of notes at once before running out of voices. When this happens, some notes may not sound at all, or you may hear note-stealing, an ugly phenomenon in which certain notes are chopped off too early. By adding another tone module, you increase the total polyphony of your system.

• Even if the synth has enough voices to play all of the notes, when it gets busy trying to start a whole handful of notes on the same beat, some of them are quite likely to start late. When the notes are spread among several synths, there's usually a lot less timing slop in the performance. (See the Mar/Apr '97 Mysteries of MIDI for more on this.)

▪ All of the sounds being played by one MIDI instrument will be processed by the same internal effects. This is not always musically desirable. For instance, you might want a big cavernous reverb on a snare drum, but a tighter room reverb on a sax solo. With only one reverb, this isn't possible. By adding a second module, you increase your palette of effects. (You can accomplish much the same thing by using an external effects processor and your synth's auxiliary audio outputs — if it has aux outs.)

• Each manufacturer's instruments have, to a greater or lesser degree, a different sound. You might like the Yamaha filters better for pseudo-analog synth sounds, for instance, but prefer the acoustic piano sound in a Roland.

Well, dang — here we are, at the bottom of the page again. Next time we'll go deeper into the MIDI system maze by talking about multiport interfaces and the Mac MIDI system utilities, OMS and FreeMIDI. But that's not the end of the story: In the months to come, we'll be talking about some specialized MIDI hardware, stuck notes, synchronization, troubleshooting, the perils of daisy-chaining, and more. ◀〰

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Jim Aikin is the senior editor of M&C's sister publication, Keyboard. *His most recent music hardware acquisition is a completely non-MIDI baby grand piano.*

Is That a Synthesizer in Your Pocket?

Call me a gadget freak, Ishmael. You can often find me cruising garage sales, flea markets, thrift stores — pawnshops, even — in search of the unusual, the impractical, the strange, the outlandish, the peculiar, and the bizarre. I like electronic gadgets the best.

Out at the Salvation Army store in Manteca (Spanish for "lard" — no fooling!), I once found a little thing that looked like a transistor radio without a tuner. All I knew was that it had a speaker, a circuit board, and an on/off switch, and used a 9-volt battery. That was good enough for 50 cents. Turned out it was some kind of voice box for a baby doll. As soon as you flipped the switch, it made these horrible crying and screeching noises for about ten seconds. Then it would be quiet for a little while, then start again. I thought about turning it on and throwing it in a dumpster behind a 7-Eleven, but as my friend Mike used to say, "That's *messed* up."

Another time, at the Second Time 'Round shop in Goleta, I found an automated fondue preparation device.

But not all little electronic gewgaws are useless. Take the trend of miniature computers. Back in the late '80s, Go Corp. spent lots of other people's venture capital on a portable "pen-based" computer that could recognize handwriting. Maybe the technology wasn't mature enough, or maybe they were ahead of their time, but for whatever reason, Go went away. Former CEO Jerry Kaplan immortalized the company's misfortunes in *StartUp: A Silicon Valley Adventure,* a 1996 book that's unlikely to be made into a TV movie starring Jane Seymour and Dennis Franz.

Undaunted by Go's cautionary tale, the ever-adventurous Apple Computer decided to give pen-based computing a go with the Newton, a "handheld" computer that supposedly could fit in your pocket. Actually it was way too big to fit in most pockets, and anyone who tried to do so looked pretty dorky unless they had really big pockets, an arguably dorky fashion statement in the first place.

Recursive logic aside, Newtons caught on in some circles. They've been through several different designs now, but the

PocketSynth proves that miniature computers aren't just for address books anymore.

fact remains: They just don't fit into your pocket.

Casio, makers of the late, lamented CZ-101 microsynth, even got into the act with the Cassiopeia, a tiny folding Windows CE-based computer that also won't fit into your pocket. Then there's the Sharp Zaurus and Wizard, the Sony Magic Link, and the Psion series. Cool? Sure. Pocket-friendly? Nope.

Take Me to the Pilot. Recently, however, I got my big hands on U.S. Robotics' Pilot, a dandy little device that is, in fact, pocket-sized. (See Figure 1.) From what I've garnered, it's going over pretty well out there in Rube Goldberg-land.

How do I know this? Shareware. There's lots of shareware out there for the Pilot. While scrolling through the online repositories of Pilot shareware, my eyes stopped dead on PocketSynth. (See Figure 2 on page 77.)

This program, by Stanford computer science student Eric Cheng, proves that miniature computers aren't just for address books anymore. You get a little graphic of a keyboard, some notes with which to set durations, and a metronome. Play PocketSynth by tapping the onscreen keys with the Pilot's stylus, and the note names and durations show up in text format. You can edit the text to alter note timing and pitch. Save your compositions or load others — the PocketSynth Web site includes a repository of users' compositions, free for the download. (Since the Pilot connects to both PCs and Macs, you can use your main computer to comb the Web for software, then transfer it to the Pilot.)

Fig. 1. *Sales of U.S. Robotics' Palm Pilot may pass 1,000,000 this year, and music shareware for this $300 pocket computer is following close behind.*

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Fig. 2. Tap PocketSynth's keyboard and you can play reference pitches, hear a metronome, or even record tunes. This screenshot was made with Zilot, a Pilot emulator that runs on Power Macs. (Get it from w3.teaser.fr/~mpollet/Zilot/.)

Eric tells me PocketSynth began life as an instrument tuner. As an orchestral musician, he merely wanted a way to get absolute pitches for stringed instruments and voice. However, he said, "The project became more ambitious." He added a method for compiling sequences of pitches, and a metronome that measures tempos by determining the speed at which users tap the stylus against the screen.

"I've received mostly good feedback from people, because Pocket-Synth is the only 'music' program for the Pilot that lets people do more than play back pre-programmed songs," Eric confided, although he notes that most people use the program for quick reference rather than for practice or recording. From my experience with the program, I'd agree it's not yet ready for serious musical use. Not that this is a fault of Eric's; the Pilot can only play back one note at a time. If this could be rectified, Eric says he'd do a lot more with PocketSynth.

"The chip supports a lot of cool stuff," he wrote in a late afternoon e-mail, "but they supposedly left out some functions. It can't even play phone tones. It's really too bad."

But it's not too too bad. None of this is to say the situation can't evolve. Just as U.S. Robotics added new features to the second generation of the Pilot, Eric said he is considering adding staff-based notation and possibly the ability to save and load songs as MIDI files. If U.S. Robotics adds more sound capability to the Pilot (for memo recording, maybe, or telephone dialing), who knows what might happen? In the meantime, I recommend downloading PocketSynth and giving Eric the respect and $10 he deserves. Get your oversized hands on the keyboard and get it from www-cs-students.Stanford.EDU/~echeng/Pilot/pilot.html.
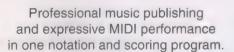
Or e-mail Eric at echeng@cs.stanford.edu. You can even order via snail mail from P.O. Box 10617, Stanford, CA 94309.

You've Got a Fret. Another Pilot shareware gem is FretBoard, by Dave MacLeod of the United Kingdom. This program provides a tiny but detailed representation of a guitar, mandolin, bass (4-, 5- or 6-string), or violin fretboard, displaying

FretBoard would be cheap at 20 times the price — because it's free.

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scales and chords as the user specifies. (See Figure 3.) But unlike that old Mel Bay book, FretBoard lets you hear the notes and scales right away.

Granted, the sound quality is not that great, but what a tool! You can instantly hear how, say, a D minor pentatonic scale compares with a D Locrian one. FretBoard shows you how to finger loads of scales, including major, minor, pentatonic, blues, diminished, whole-tone, Dorian, and Mixolydian types.

Now how much would you pay? But don't answer yet, because you also get displays of chords in every key, be they major, minor, 6th, 7th, 9th, 11th, 13th, 6/9, sus4, diminished, augmented, what-have-you.

But wait — there's more. You guitarists also get fingerings for open C, D, E and G, crossnote and modal D and G tunings, and that old favorite, DADGAD. You can make up your own tunings, scales, and chords, and can orient the neck view in any direction you prefer.

FretBoard would be cheap at twice the price, or four times, or 20 times — because it's free. The software is certainly cool, but it takes a little getting used to. The esteemed Mr. MacLeod saved himself a lot of programming work by providing what amounts

to a universal view for all scales and chords. At first it appears that all notes are selected, but the pertinent ones change sizes and shapes depending on which scale or chord is chosen.

MacLeod says this technique saved him from having to devise a database of standard scale and chord shapes. And while people have asked him to do so, he says he doesn't have the time. In case someone out there really wants to implement a chord database in FretBoard, the source code is publicly available to download and modify. Do your duty and download FretBoard from www.netcomuk.co. uk/~davmac/pilot.htm.

Liftoff. For more information on the Pilot, visit www.usr.com/palm/. To download more music apps, search on "sound" at www.pilotgear.com. In fact, you don't even need a Pilot to explore the world of Pilot shareware. Pilot emulation software runs under Windows, Mac OS, Linux, and even OS/2, although you'll need a copy of the Pilot ROM file to run it, and this is only available legally to registered developers. Stop by userzweb.lightspeed.net/~gregh/pilot/copilot/ for more information. 🔊〰

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John Poultney is a staff writer at MacWeek

Fig. 3. *FretBoard shows (and plays) scales and chords for guitar, mandolin, bass, or violin. And it's free.*

magazine in San Francisco. If you don't find him there, or playing bass with his group, the Human Torches (www.actionpacked.com), you're not looking hard enough.

Music for Video (Part 2)

I was recently reading *Experiencing Music Technology* (by Peter Webster and David Williams, Schirmer) and came across an interesting observation: Music, from its very beginning, has always been a multimedia experience. In religious ceremonies, social gatherings, theater, and other settings, music was inseparable from movement, images, and interaction. It wasn't until the advent of inexpensive recordable media that music became something that many of us just sat and listened to.

As we started to see in my last column on making music for video (July/Aug '97), computers are offering greater capabilities, which let us put the multimedia aspect back into our students' music experience. This time, we'll take a look at how one music educator is working to bring these advances into the classroom, and get some sound advice on what you need to consider when you put together your first multimedia class.

Prologue. Ted Scalzo of Bay Shore High School in Bay Shore, NY, is a leader in the effort to return music to an active multimedia experience. He's part of an excellent music faculty that enjoys strong support from its administration and community. In addition to handling the marching band duties at BHS, Ted teaches a multimedia class that developed as an extension of his music theory class.

"We were looking for new ways to stimulate performance and composition," Ted explains. "As early as 1990, our students were already bringing in movie clips of their choosing and creating music to go along with them. Students used basic MIDI sequencing software and synthesizers to create soundtracks, and would then use the dubbing feature on a VCR deck to place the soundtrack directly onto video tape. Students would rehearse their performances while watching their video and just try to 'eyeball' certain cues. They also experimented with tempos in the sequences to try to sync the music with certain spots on the video tape."

By 1995, the primary workstation for Ted's class had grown to include a Macintosh 840 AV with a 2GB hard drive and Adobe Premiere (multimedia presentation software that lets you digitally record video, as well as import digital audio and Standard MIDI Files). Using the built-in video inputs on the 840 AV, students would capture video clips to make digital QuickTime movies at resolutions of around 240 x 320 pixels (about one-fourth the area of a 15" computer monitor). The digitized movies were then archived onto compact discs using a CD-ROM recorder.

The student-produced QuickTime movies were fine for viewing on a computer screen, but Ted wanted his class to have the option of making a finished, high-resolution video tape. A Radius VideoVision card, which provides full-frame (broadcast-quality) video output, was added to the Mac AV workstation. It was at this point

When teacher Ted Scalzo showed the school board members what the kids had already done in class, they were stunned.

that Ted stumbled onto one of the biggest hurdles with digital video — storage space. Although a 2GB hard drive is large enough for most computer workstation needs, it's inadequate for storing full-frame digital video. Since broadcast-quality video clips take close to 500MB of storage space per minute, he needed a bigger hard drive, which was going to cost more money than he had in his budget.

As luck would have it, the superintendent of schools wanted to produce a video tape of an event that was being held to promote a technology bond referendum. Ted convinced her to take the money she was going to spend having the video professionally shot and edited, and spend it on additional equipment for his multimedia class. He proposed that the students be allowed to shoot and edit the video themselves. ☞

It was initially a very hard sell, but when he put together a presentation for the school board of what the kids had already done in class, and what they would be able to do with the new equipment, the board members were stunned (see Figures 1 and 2). They were so impressed with what the students were doing that Ted was given the funds to build a new multimedia station complete with an 18GB disk array. [*Ed Note: A disk array is a group of hard drives that is configured to allow large amounts of data to be transferred between computer and array at high speeds and without interruption.*]

In the end, Ted's class completed the video project with less-than-professional results; however, that didn't matter to Bay Shore community members. Instead of focusing on the negatives, everyone was pleased that the students were involved.

Fast Forward. Today, Ted's top workstation is a Power Mac 9600 with 168MB of RAM. A Media 100 video card installed in the Power Mac is used to capture video shot by students and turn the digitized video into full-frame QuickTime movies. The final edited movies are recorded onto Super-VHS tape.

Ted is adamant about the quality of the video his students digitize into the system. "The dirt on poorly maintained recording cameras introduces fuzz and a grainy quality to the video that causes the resulting digital video file to be needlessly large," he explains. "For this reason, the class now uses S-VHS cameras and tape decks, which provide a higher quality image than regular consumer VHS machines."

Looking toward the future, Ted is excited for his students as they integrate the new equipment into their program. As part of the class curriculum, he plans to emulate a multimedia/advertising business in which his students are responsible for all aspects of the products. The kids will produce original interactive CD-ROMs as well as custom videos with original soundtracks. Any profits generated from these projects will be used to keep the equipment maintained and the software up to date.
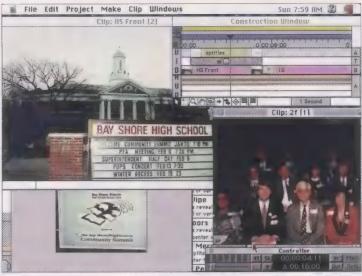

Fig. 1. *Using Adobe Premiere (Mac/Windows/Unix), students at Bay Shore High School combined digital audio and video into a presentation that captivated audience members. As a result of the students' efforts, the community passed a bond referendum that gave teacher Ted Scalzo the funding he needed to expand his multimedia lab.*
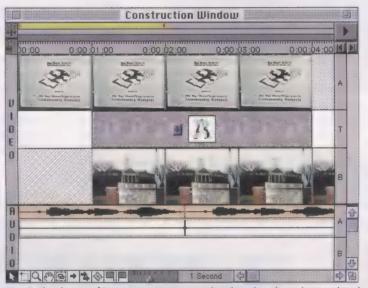

Fig. 2. *This close-up of Premiere's construction window shows how the students combined video, graphics, and audio by simply dragging and dropping material along the horizontal time line. Note the two dedicated video and audio tracks, plus the "T" track between the two video tracks. This track lets users drop in professional-looking transitions. The line below the digital audio waveform in the audio track lets users draw in volume changes.*

You Can Handle the Truth. It's certainly true that the lack of computers capable of running music/multimedia applications is a concern for many educators. Not all of us will have the funds to equip a multiple workstation lab such as Ted's, but this limitation can actually be an educational benefit.

"A few workstations are all you need, since there are a lot of important things to do besides use the computers," says Jay Fern, who teaches the Master of Science in Music Technology program at Indiana University/Purdue University. He feels that educators can "use the limited access to equipment as an advantage by helping students understand that this is a very precious commodity — the real world doesn't throw expensive stuff at you any more than schools do. It's an important life lesson."

Planning is the key to managing computer time in Jay's class. Students in his program go through the process of creating a detailed storyboard before ever putting their hands on a camera. Every shot is planned. There's also dialog to practice, props to find, and of course, music to write and rehearse.
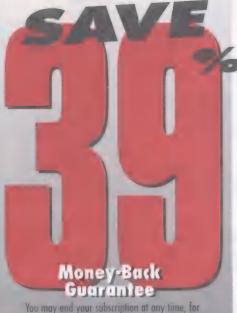
But forethought and preparation aren't just for the students. Jay advises that educators plan curriculum objectives carefully and make sure that adequate storage is available to achieve these classroom goals. As he explains, "Higher-end equipment is really of no use to your class if you can't have the disk space to store the data. That $3,000 graphics card you spent your entire budget on is useless if students don't have a way to store the movies they create!"

Jay also stresses the importance of having a few different ways to back up projects, since you're not going to be able to store data for an entire class on one device, even with the largest hard drives available. Also, workstations have a tendency to crash, which could cause you to lose work. Having multiple storage units, such as CD-ROM recorders and removable-media hard drives, will spare you (and your class) downtime and headaches later on.

One final note: Multimedia technology is constantly evolving, and the only way you can keep up is to let your students become experts too. As Jay so aptly puts it, "When it comes to teaching with technology, it's better to be the guide on the side than the sage on the stage." ◀ᴡ

Ken Johnson has been a music educator for 15 years. He's currently the educational sales manager for Opcode Systems. Please send your ideas on computer-enhanced music education to him at kenj@opcode.com or call 847-540-7372. He'll share the best ideas in upcoming columns.

MOD Philes

By Eric Bell

MORE ON THE WEB

mitted by you trackers.

Whirled Peace. As Jace Cavacini (a.k.a. **Splattered Mind**) puts it, "Peace Never Stays." His 8-channel FastTracker composition of that name "started out as an experiment in positivity and ended up as a photograph of quiet unhappiness."

"Peace" uses simple samples such as piano and bell and many monophonic melody lines to create its sonic landscape. An arpeggiated string sample is accented by single piano notes to outline a fairly pedestrian chord structure.

In the middle of the piece, some loud piano notes herald a change in mood and tonality. Increasing dissonance and energy are carefully and seamlessly woven into the fabric of the piece as it gains in intensity. The types of figures used so effectively in the first, calmer phase of the song are maintained, but more individual notes are used. It's as if the notes themselves were spawning and cloning into something evil. The piece ends quickly with a fade-out, leaving the listener stranded in a not very welcoming place.

One interesting effect is the echoed bell sounds in the middle of the tune. Isolate tracks 5 and 6 and you'll hear how Spattered Mind plays the sample multiple times on different tracks at different volumes to achieve this multi-tap delay effect.

I would describe "Peace Never Stays" as "tracked pointillism" — a composition made of many individual spots of sound. This track is all about emotion and structure. The melodic and harmonic devices employed transmit this emotional energy flawlessly to the listener. It's straightforward, yet very powerful.

changed from a piece of music into a journey.

Compare "His Moment Cut Short" — also by Splattered Mind — which also relies heavily on piano samples and simple chordal structure. This piece, released in support of the National Missing Children's Organization, starts slow, gains in intensity, and then, via a repeating piano figure, evokes the tragedy of a child gone missing as a repeated note fades slowly away. There's a denouement in a minor key, and a quiet ending. It's another set of emotions and transitions, effectively translated — in this case, for a very good cause.

technique.

Somebody Stop Me. After all this molto-heaviness, we need something light and jazzy, right? Have a listen to "Stop" by **Smash**, a member of the music group Beam (www.netup.no/~tobben/ beam/). It's fun, with a nice rollicking shuffle drumbeat that's uplifting and easy to take. Some cool vocals keep it on track, too.

The samples in this song are wisely chosen. They're carefully mixed and blended to work well together. The smooth-sounding keyboard pads are balanced by quiet, resonant samples zipping to and fro. A light groove is laid down right from the start of the song, and the easy walking feel of the piece is maintained throughout.

Of note are the vocal samples, which sound highly processed, and chant (at appropriate times), "Can't stop . . . just

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MORE ON THE WEB

Tracker Treat

Emotions are very important in life — and in music. Yet they are difficult to embrace and even harder to express. What is music if not a vehicle to express emotions in a way that's free of the constraints of language, in a way that can be understood and felt by all? At a time in my life when great changes are afoot, I find myself listening to a brace of very emotional compositions submitted by you trackers.

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In the middle of the piece, some loud piano notes herald a change in mood and tonality. Increasing dissonance and energy are carefully and seamlessly woven into the fabric of the piece as it gains in intensity. The types of figures used so effectively in the first, calmer phase of the song are maintained, but more individual notes are used. It's as if the notes themselves were spawning and cloning into something evil. The piece ends quickly with a fade-out, leaving the listener stranded in a not very welcoming place.

One interesting effect is the echoed bell sounds in the middle of the tune. Isolate tracks 5 and 6 and you'll hear how Spattered Mind plays the sample multiple times on different tracks at different volumes to achieve this multi-tap delay effect.

I would describe "Peace Never Stays" as "tracked pointillism" — a composition made of many individual spots of sound. This track is all about emotion and structure. The melodic and harmonic devices employed transmit this emotional energy flawlessly to the listener. It's straightforward, yet very powerful.

The next time you do a composition, try a transitional technique. Start with a simple, clear theme, emotion, or feel, and see how seamlessly and effectively you can take the listener to a different place. If you accomplish your goal, your composition has changed from a piece of music into a journey.

Compare "His Moment Cut Short" — also by Splattered Mind — which also relies heavily on piano samples and simple chordal structure. This piece, released in support of the National Missing Children's Organization, starts slow, gains in intensity, and then, via a repeating piano figure, evokes the tragedy of a child gone missing as a repeated note fades slowly away. There's a denouement in a minor key, and a quiet ending. It's another set of emotions and transitions, effectively translated — in this case, for a very good cause.

> **The next time you do a composition, try a transitional technique.**

Somebody Stop Me. After all this molto-heaviness, we need something light and jazzy, right? Have a listen to "Stop" by **Smash**, a member of the music group Beam (www.netup.no/~tobben/beam/). It's fun, with a nice rollicking shuffle drumbeat that's uplifting and easy to take. Some cool vocals keep it on track, too.

The samples in this song are wisely chosen. They're carefully mixed and blended to work well together. The smooth-sounding keyboard pads are balanced by quiet, resonant samples zipping to and fro. A light groove is laid down right from the start of the song, and the easy walking feel of the piece is maintained throughout.

Of note are the vocal samples, which sound highly processed, and chant (at appropriate times), "Can't stop . . . just

MOD Philes

can't stop!" Surprisingly, these samples were recorded with a Sound Blaster 16 and a cheap mic (probably the plastic one that comes with the Sound Blaster). A little processing was done in Sonic Foundry Sound Forge to massage the samples. The effect is perfect for the song.

Along with "Stop" came "Sleep Sweetly," a complete track made with only sine waves as samples — the whole thing weighs in at 19KB! There's practically nothing making up this piece except pure expression. Why use up a lot of bandwidth in order to get your point across?

The point here is, you don't need expensive equipment to make effective samples or great-sounding songs. That's the wonderful thing about tracking — you can make digital compositions with an inexpensive soundcard and free software tools. So what are you waiting for? Stop by the MOD Philes site and make some music! ◀〰

Eric Bell is the Top Dog of Howling Dog Systems, makers of Power Chords software. He enjoys guessing the prices of infomercial items: "Three easy payments of . . . $19.95!"

MOD Philes Online

You can reach the MOD Philes Web site and have your say in our new Usenet newsgroup by visiting www.howlingdog.com. There you'll find the tunes we write about, tools to play and compose MODs, other readers' feedback, and lots more.

To submit your original MOD tunes, just log on and follow the instructions. If your composition is selected for coverage in this column, you'll receive one of a number of fine prizes. These include **Midiman's MultiMixer 6** mixer (visit them at www.midi-farm.com/midiman), **Sonic Foundry's Sound Forge XP** audio editing software for Windows (see www.sfoundry.com), and **Schatztruhe's MODs Anthology** CD-ROM of 18,000 MOD files (see www.schatztruhe.de or www.ninemoons.com). ◀〰

Mental Floss MODcast

The recent POTS live-to-Internet broadcast by Mental Floss (Andrew McCallum) was a huge success. Andrew mixed and performed original music using Impulse Tracker, two Gravis UltraSound cards, a Yamaha CS1x synthesizer, and a Boss mixer and effects box. He then compressed the audio signal in his Pentium 133 and sent it over a normal phone line (aka POTS, for "Plain Old Telephone Service") to the Interlog RealAudio Internet server. To listen in, all you needed was the RealAudio 3 player on your computer; you then simply clicked a link on the Mental Floss Web site.

While the broadcast was taking place, listeners world-wide were participating in a live IRC chat so we could all compare what the broadcast quality was like, what we liked (or didn't like) about the tunes, etc.

To use MOD files in live performance, Andrew starts a pattern running in Impulse Tracker, with only certain channels turned on. "As I want the song to progress," he explains, "I turn channels on and off appropriately. This is similar to using a multi-channel mixing board. I also swap samples in and out by changing the sample numbers, and sometimes change the patterns themselves."

Keep an eye on Mental Floss's home page (www.io.org/~andrewm/) to see when there might be a repeat performance. There's lots of tracked music to check out as well. Try the tune "EarthTones" first if you like techno. ◀〰

How Do I Add Audio to My Web Site?

I recently redesigned my personal Web site. I updated all the information, added new topics, and slapped together some really snazzy graphics. But in revising the page for *Pieces of Imagination* (my cassette album), I faced a bit of a dilemma. The audio snippets I had posted when the site was first created were still in the old .AU file format. Since .AU files are static (meaning they have to be downloaded before you can start listening to them), they had to be small, or else they would take forever to transfer. It was about time that I switched to a "streaming" audio format, so that I could make the samples longer and anyone visiting my site could immediately begin listening while the file was downloading.

I decided to go with the RealAudio format, since that's what most folks expect to find on the Web these days. [*Ed. Note: See our Jan/Feb '97 cover story on realtime Internet audio for background on RealAudio and other streaming audio formats.*] I couldn't just convert my .AU files to RealAudio though, because both formats use "lossy" data compression, which reduces file size by throwing away part of the audio signal. I needed to record everything all over again in order to get the best quality possible.

Press the Red Button. After connecting the audio outputs from my DAT (digital audio tape) deck to the audio inputs on my soundcard, I used Sonic Foundry Sound Forge to record each tune on the album onto my computer's hard drive. I made sure to use recording settings of 16-bit, 44,100Hz (CD quality). For each tune, I adjusted the soundcard's input levels to get the signal as close to –3dB as possible without going into the red. By utilizing the full amplitude range, I helped ensure that my sound files had the least possible noise and distortion. Of course, I could have avoided all the level jockeying by doing a direct digital transfer from the DAT, but unfortunately, the soundcard I was using doesn't have digital audio inputs.

Pre-processing. Now that I had all the songs transferred, it was time for a little torture. Since the RealAudio encoding process uses massive amounts of data compression, a straight conversion to the RealAudio format wouldn't do. In order to make the audio files sound decent after encoding, I had to make them sound *worse* beforehand.

Before I started hammering on the sound, I used Sound Forge to remove any *DC offset* that might have crept in during recording. DC offset in a sound file is present when the audio isn't centered around the zero-volt line (axis). This usually occurs because of an improperly grounded soundcard, and can add excess noise (or even a low rumbling sound to RealAudio files) when any processing is done to the audio.

Next, I put each of the tunes through Sound Forge's Graphic Dynamics effect. (See Figure 1 on page 84.) This is similar to a hardware-based audio compressor, but more powerful, because you can edit the settings graphically. (Audio compression takes the loudest sections of a sound and reduces their level by a preset ratio, allowing the overall volume to be increased without overloading at the peaks. Unlike data compression, it has no effect on the *size* of an audio file.)

I decided to use a compression ratio of 2:1 on each of my songs. In other words, whenever the signal rose above a certain threshold, Sound Forge would reduce the portion over the threshold to half its original level — for every 1dB the original waveform exceeded the threshold, the new waveform would exceed it by only 0.5dB. This would allow me to increase the volume a bit (later on) but also keep some of the original dynamic range. Too much compression can add unwanted artifacts to music and make it sound dull and lifeless. A good ratio for compressing an entire mix is between 2:1 and 4:1, but it'll vary with

> **I linked my song titles to the appropriate metafiles, and . . . it worked! I was now part of the streaming audio crowd.**

the material, so you'll have to use your own judgment.

Because the RealAudio encoding process discards a lot of the high-frequency (treble) portion of an audio signal, some EQ (equalization) compensation was needed. A good midrange boost at about 2.5kHz was all it took. To accomplish this, I used Sound Forge's Paragraphic EQ processor, which lets you specify a center frequency to be boosted or cut, as well as the "width" (or range of adjacent frequencies) that will be affected. (See Figure 2.) I set the center frequency to 2,500Hz and the width to one octave. Then I experimented a bit with the gain to get a nice full sound for each song without making it too thin or tinny. Most of the tunes called for a boost of 6dB or so.

The only pre-processing left to do now was to *normalize* each audio file. Normalization raises the volume of an audio signal as high as it can go without causing clipping (distortion). Instead of normalizing my files to 100%, however, I kept each one just under the max by using a setting of 94.41% (–0.50dB). This is because the RealAudio encoding process doesn't always handle 0dB signals very well, so it's best to leave a small amount of room for it to work its magic.

Save As . . . Finally, I was able to convert my files to RealAudio. Since Sound Forge has this function built in, there was no need to bother with another program. Those of you without Sound Forge can easily download a free encoding program from www.realaudio.com. RealAudio provides a number of different options for encoding files, including mono or stereo as well as optimizations for several modem speeds (14.4, 28.8, ISDN). I went with 28.8kbps since it sounds decent and is the standard modem speed these days. The 14.4 option is really best suited for speech, not music.

Now I just needed to decide if I wanted to go mono or stereo. I tried it both ways, and believe it or not, mono sounded better. With a stereo setting, the highest frequencies you'll hear are around 4kHz. In mono, the frequency response jumps to about 5.5kHz, so the audio sounds clearer. This is because with a stereo file, twice as much data would have to be pushed through the phone line,
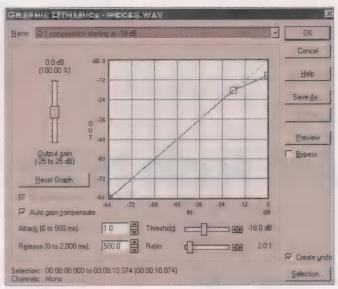
Fig. 1. *The display in Sound Forge's Graphic Dynamics processor shows how an audio compressor works. When the transform line is at a 45° angle, the audio file is unaffected. As the line is pulled down, portions of the output file that exceed the level threshold along the horizontal axis are progressively reduced in level. The attack and release settings (bottom left) control how quickly the processing takes effect when a peak is encountered, and how quickly it returns to normal after the peak.*

so the RealAudio encoder discards some high frequencies to save space. With mono, there's less data to push, so more high frequencies can be retained. Besides, if anyone wants to hear my material in all its stereo glory, they can buy the tape, right?

Post-process. With my files encoded, it was time to post them on my site. I added links to each file from the relevant song titles on the page, then uploaded everything. "This is going to be cool," I thought.

>Click.<

"Hey — wait a second." Why was the file downloading instead of streaming? I knew

that my ISP (Internet service provider) was set up for RealAudio files, because otherwise the file wouldn't have launched at all. What I didn't know was that my ISP doesn't have an actual RealAudio server (usually required to stream RA files), but had just created the appropriate MIME type so that Web browsers would recognize when someone clicked on a RealAudio file.

Luckily, there was another way. Called *HTTP streaming*, this protocol allows anyone to stream RealAudio files from their Web site, even without a special RealAudio server. The trick is to create what is called a "metafile." This is just a plain text file that holds the URL of the RealAudio file you want to stream. You give the metafile the same name as the RealAudio file, but with the extension ".RAM" instead of ".RA." I linked all my song titles to the appropriate metafiles, and . . . it worked! I was now part of the streaming audio crowd.

Other Options. Of course, RealAudio wasn't my only streaming option. Macromedia's Shockwave is another alternative, and it's also supposed to sound better. On top of that, the Shockwave player can easily be embedded into a Web page so that it automatically loads onto a user's system if they don't already have it. If a user doesn't have the RealAudio player, they have to surf over to the RealAudio Web site to get it. Unfortunately, creating Shockwave files isn't free on all platforms. Mac folks need Macromedia's SoundEdit 16. (Windows users can get by with a free plug-in available on www.macromedia.com.) Liquid Audio (www.liquidaudio.com) is another prominent streaming technology, but it isn't free either.

Have you ever wondered, "How do I. . . ?" Send your desktop music questions to me at garrigus@pan.com. I'll try to answer them in future columns. ◀〜

Fig. 2. *To compensate for the loss of brightness that can occur when audio is converted to the RealAudio format, I preprocessed the signal with Sound Forge's Paragraphic EQ, boosting the frequencies around 2.5kHz. Paragraphic EQ combines the control of parametric EQ (which lets you adjust the center frequency as well as the range of frequencies affected) with the straightforward layout of a graphic EQ.*

Scott Garrigus invites everyone to take a listen to the sensational streaming songs from his Pieces of Imagination *album at www.village2000.com/comp.media/. And if you decide to order a copy of the tape, he won't complain.*

The more I look at Fat Labs' soundcard certification program, though (see www.fatman.com/bstchce.htm), the more I see that you have to look at an entire system in order to guarantee that anything's going to work. The hot-rod concept of computers ("Upgrade your card, and then when all your friends upgrade their cards, you can beat them by putting on bigger slicks") won't fly. If that process continues long enough, people run out of money at different times, people decide that different things are important, and pretty soon it becomes very difficult to find a cover to fit your car.

I have a lot of faith in the folks who work in this business, that each one of them is trying to do what's best, somehow or another. But the desire for hot rods is fundamentally irritating to the problem of incompatibility.

The Unsound Canvas. When Team Fat got together six years ago, we swore to come to grips with the fact that we were building sand castles. We knew that we were writing for something that would crumble. That's the nature of everything, anyway, and at least we have the advantage of being able to see it crumble while we're looking at it. We swore that the thing that would make us tick was just the love of building sand castles.

However, there's another side to that: It's nice to have people exposed to those sand castles before they crumble. There may be ways to prolong the sand castles a little bit — if only to resist stomping on them ourselves.

I wonder how a computer-product manufacturer would fill in the blanks in this sentence: "This product is 100% compatible with every piece of software and hardware we know of that was made between _____ and _____." From conversations I've had, I expect it's around nine months at the outside. *Any one of the hardware or software products you own is going to fall out of compatibility with some other product you own within nine months.* I wonder if it's possible, by jumping through a million hoops and raising the price of a soundcard to $500, to generate a product that would clean up our little corner of the world.

Why We're Here. Team Fat recently looked at everything we've been focusing our attention on, from Project Bar-B-Q to encouraging the industry to create this crazy concept card. We looked at getting new Nudie suits made, at doing more mailers and publicity, at having a Fat Man game done, at writing books, at doing more crazy

back-page articles for wild magazines, and the one thing we come back to is music. It's the thing that's worth focusing on for us, because it's the thing that. as human beings, we bring to the world.

How do I as an artist deal with what is happening to my past work, and what may happen to my future work? I personally need to emphasize my strongest skill, which is composing and producing, and just doing art. I'll temper that with *some* knowledge of and influence on what's happening in the tool area, but I *cannot* get imbalanced in that direction. I believe I've found a solution, which I'll tell you about next issue. Until then, as Texas Bix Bender says, if you're riding ahead of the herd, take a look back every now and then to make sure it's still there.

The Fat Man, George Alistair Sanger, is internationally known as the biggest name in music for interactive entertainment. Together with Team Fat, his gang of cowboy composers, he has contributed the musical scores for over 100 software products. For more Fat thoughts and music, visit www.fatman.com.

Truth & Nudie

H ere's a question: Did your record player become obsolete every two years? Every five years? Every ten years? Maybe the computer industry ought to look at its numbers in this regard.

I've written music for a lot of computer games, and many of those games were created for technology that is no longer viable. Worse, there are more and more plans to make more and more of that technology not viable.

Now, on one hand, this is very natural. We had LPs and we graduated to CDs. We had to buy all-new versions of our music, but everything's okay now. On the other hand, in the computer world, it seems like we're changing from LPs to CDs to something else every nine months; the cycle of these products' compatibilities is very, very short.

In audio, there's no such thing as a stereo receiver that's upgraded and is suddenly incompatible with the tape player — which then needs to be upgraded, and now *it* doesn't work with the CD player, which then needs to be upgraded, which then causes you to need a new receiver again. The components aren't interlocked that way. You can improve one of them, and then you may have a weakest link, but it doesn't stop the rest of them from working.

Waxing & Waning. I just want to see a sense of responsibility toward the past. This may be a weakness on my part, in not being able to see the entire picture. In fact, we may *not* be going from LPs to CDs to ZDs. We may still be in our wax-cylinder phase, which means that this was a necessary step to get the whole thing launched, and that whoever made the software for the wax cylinders is just out of luck. It's not that the record player manufacturers are trying to rip off consumers, or that they only have their eye on the buck and aren't being responsible about backward compatibility. It could be that they're simply trying to work through this phase themselves. And since that view of the world

> There is no such thing as a stereo receiver that is upgraded and is suddenly incompatible with the tape player.

throws a little less blame around, it's probably the truer one.

This compatibility-vs.-upgrades dilemma is intensified because the applications that work at any given time — not just games, but spreadsheets, utilities, even operating systems — are all mixed in together, so that very little of what manufacturers are concerned about preserving is art. A small percentage of what gets lost in these upgrading processes has lasting value to the world. Therefore, roughly 100% of the art gets shoveled under with the rest of the old, now-useless programs.

I'd be the last person to suggest that time stop marching on. Yet I sometimes wonder if the computer industry could take a cue from auto manufacturers. General Motors builds concept cars. Every once in a while, they come up with something very futuristic — the car drives itself using sonar, or has Velcro on the gas pedal, or something else that becomes part of our daily lives. I don't think General Motors sincerely expects these cars to go into production anytime soon, but the process of building a concept car is good R&D for things that really will be useful someday. I wonder if it wouldn't be wise for some soundcard manufacturer to pitch in and create a concept soundcard that would attack the issue of backward compatibility, a soundcard that would be 100% compatible with everything over some nice wide period of years — say, five or ten.

It would be hi-fi and would include real Yamaha FM. It would have a Roland Sound Canvas onboard for General MIDI playback, solid Sound Blaster support, and perfect DLS (Downloadable Sound) compliance. It might even include Project Bar-B-Q's five-year projection of what a soundcard would need. (See my July/Aug '97 column.) It would incorporate Microsoft's requirements for an Entertainment PC, which, rumor has it, have been influenced somewhat by the Bar-B-Q report.